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OF THE

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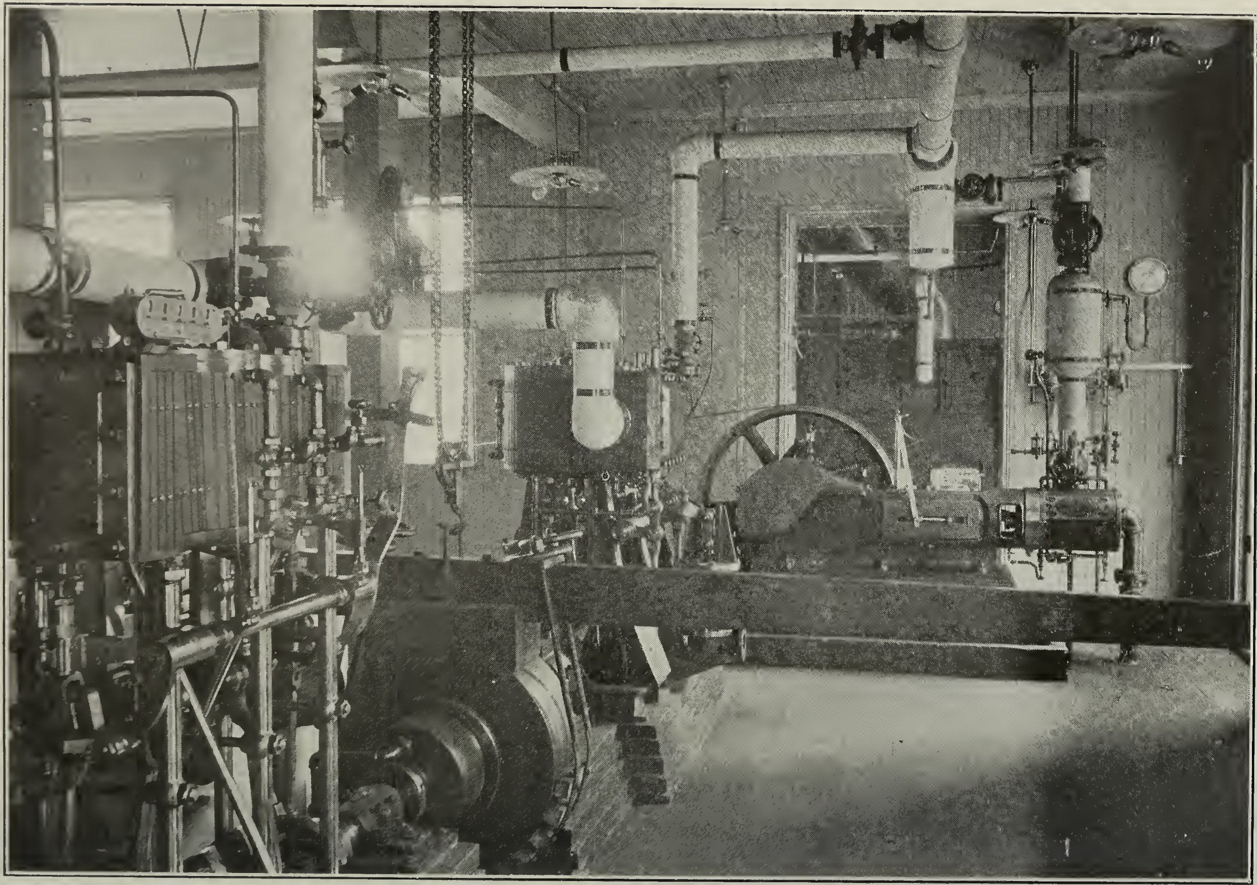

ENGINE AND BOILER PLANT, MECHANICAL LABORATORY.

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24 AUG 1914

ANNUAL REGISTER

OF THE

Baltimore Polytechnic Institute

311-331 COURTLAND STREET

TWENTY-SECOND
ACADEMIC YEAR
1906-1907

PRESS OF
MEYER & THALHEIMER,
BALTIMORE.
1906

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BALTIMORE POLYTECHNIC INSTITUTE.

HISTORICAL SKETCH.

The Baltimore Polytechnic Institute, the second manual training school established in the United States as a part of a public school system, is one of the several educational institutions of the secondary grade maintained by the City of Baltimore.

Although it is believed that tentative efforts to engraft manual training upon the city's school system were made as early as 1873 or '74, yet the action which led to the establishment of this school was not taken up until April, 1883. At a meeting of the Board of Commissioners of Public Schools, held on the 24th of that month, Mr. Joshua Plaskitt, Commissioner for the Ninth Ward, offered a resolution for the appointment of a committee "to consider . . . the advisability of establishing a school or schools for manual training." The resolution was adopted, and the committee thus appointed recommended the establishment of a school "for manual education" The necessary enabling ordinances and enactments having been passed by the City Council of Baltimore and the General Assembly of Maryland, the school was organized and opened on February 26th, 1884, under the name "Baltimore Manual Training School," with Dr. R. Grady as Director.

In January, 1886, the faculty was reorganized, Lieut. John D. Ford, an officer of the Engineer Corps of the United States Navy, who had been detailed for duty at the school, becoming Principal.

From the opening of the school applicants for admission had been required to pass through the eighth grammar school grade, or to show satisfactory evidence of having had equal instruction; but in September, 1888, it was decided to admit pupils of the 6th, 7th and 8th grammar grades. This action opened the school to so large a number of young boys that increased accommodations became imperative, and in June, 1890, the new building, devoted to the academic studies and drawing, was finished and occupied.

Lieut. Ford was recalled to the naval service in June, 1890, and was succeeded as principal by John W. Saville, a retired member of the Engineer Corps of the Navy.

In May, 1893, the name of the school was changed to "Baltimore Polytechnic Institute," and the titles of Principal and Vice-Principal to President and Vice-President, respectively.

Mr. Saville resigned in August, 1899, and was succeeded as President by Lieut. William R. King, Engineer Corps, U. S. N., the present head of the school.

The new charter of Baltimore went into effect on March 1st, 1900, and under one of its provisions it devolved upon the Mayor, Hon. Thomas G. Hayes, to appoint, as the head of the Department of Education, a Board of School Commissioners composed of nine persons, to serve without pay, and to be chosen from among those citizens he deemed "most capable of promoting the interests of public education, by reason of their intelligence, character, education, or business qualifications." The names of the distinguished citizens so chosen will be found on page 15.

Another provision of the Charter requires that "in order to secure the continuance of local interest in, and oversight of the public schools, there shall be appointed by said Board of School Commissioners such number of unpaid School Visitors as may be found requisite." In pursuance of this provision there was appointed as a Board of Visitors to this institution a group of gentlemen, some of whom are recognized in technical circles throughout the country as being at the head of their respective professions.

The members of the Board of Visitors had no sooner acquainted themselves with the general conditions prevailing in the school—the age and attainments of the pupils of the lower grades, the character of the work done, and the scope of the curriculum—than they submitted to the Board of School Commissioners a very comprehensive and exhaustive report discussing the condition, needs, and aims of the school, and recommending certain changes in the requirements for admission, and in the curriculum. The partial adoption of this report in September, 1900, excluded grammar school pupils from the institute, thus making the standard for admission the same as that for the City College.

In April, 1901, a further consideration of the report of the Board of Visitors led to the practical addition of one year to the course by permitting graduates to remain for a year of postgraduate work; and in May, 1902, the length of the course was, by action of the Board, set at four years for pupils entering on and after September 15, 1902.

It was further provided that pupils leaving the Institute before the completion of the course should receive certificates of the work done by them up to the time of their withdrawal.

By operation of the new Charter the titles of President and Vice-President were changed, in 1900, to Principal and Vice-Principal.

RECORD OF THE FACULTY AND STAFF.

From the Origin of the Institute to December 1, 1906.

The school was organized on February 26, 1884, under the name "Baltimore Manual Training School"; this name was changed in May, 1893, to "Baltimore Polytechnic Institute."

Richard Grady, M.D., D.D.S., Director, February 26, 1884. Services terminated January 11, 1886.

John D. Ford, P. A. Eng., U. S. N., Instructor in Drawing and Steam Engineering, February 26, 1884. Principal, January 11, 1886. Recalled to Naval Service, June 30, 1890.

William Dugent, Instructor in Wood Work, February 26, 1884. Transferred to Pattern Shop, January 11, 1886, and was in charge of that Department until September 17, 1900.

J. H. W. Onion, Instructor in Pattern Department, March 1, 1884. Services terminated June 30, 1886.

A. Newton Ebaugh, First Assistant in Academic Department, January 11, 1886. Vice-President, May 1893. Transferred to Baltimore City College, June 30, 1896, as Professor of History and Political Economy.

C. F. Friese, Instructor in Metal Department, September 1, 1886. Resigned to accept position in Chicago Manual Training School, June 30, 1891.

W. H. Hall, B. C. C., '85, Assistant Instructor in Physics and Chemistry, September 23, 1886. Instructor in Academic Department, June 7, 1898. Head of Department of Physics and Chemistry, September 13, 1899. Head of the Department of Science, June 21, 1901. A. M., Washington College, 1906.

William G. Richardson, Assistant Instructor in Machine Department, February, 1887. Instructor in Machine Work and Engineering Materials, September 13, 1899.

Andrew J. Pietsch, Assistant Instructor in Academic Department, September 1, 1887. Transferred to be Principal of Male Grammar School No. 4, September, 1890.

J. C. McSherry, Assistant Instructor in Academic Department, September, 1887. Resigned, April 1888.

Richard Piez, B.M.T.S., '87, Instructor in Mechanical Drawing, September, 1887. Resigned, September 1891.

Lawrence Griffith, Assistant to the Principal and Instructor in Freehand Drawing, September, 1887. Resigned, June, 1890.

John L. Yater, Assistant Instructor in Academic Department, September, 1888. Transferred to be Principal of Annex School No. 14, January, 1899.

Flavius J. Pennington, B.M.T.S., '87, Assistant Instructor in Wood Department, September, 1888. Resigned, April 1, 1899.

David G. Butterfield, Assistant Instructor in Academic Department, September 11, 1888. Transferred to be First Assistant in Male Grammar School No. 20, March 19, 1889.

Thomas G. Ford, B.M.T.S., '88, Assistant Instructor in Wood Department, October, 1888. Assistant Instructor in Carving and Pattern-making, September, 1897. Instructor in Pattern-making and Wood-turning, September 17, 1900, and, in addition, Assistant in Mechanical Drawing, September, 1902. Instructor in Carpentry and Pattern-making, September, 1903. Resigned, November 1, 1906.

John T. Robinson, Assistant Instructor in Sheet Metal Department, October, 1888. Resigned to become Instructor in Sheet Metal Work at the Brooklyn Polytechnic Institute, Brooklyn, N. Y., June 30, 1894.

J. Ward Willson, M.D., B.C.C., '61, Assistant Instructor in Academic Department, March 21, 1888. Instructor in Academic Department, September, 1898. Instructor in History, Physiology and German, September 16, 1901. Instructor in German, English and Science, September, 1902.

George M. Gaither, B. M. T. S., '88, Assistant Instructor in Wood Department, April 1, 1899. Instructor in Carpentry and Carving, September 17, 1900. Supervisor of City Manual Training Centres in addition to Institute duties, September, 1902.

Richard H. Uhrbrock, B. C. C., '86; Ph.B., I.W. U., '97; Assistant Instructor in Academic Department, May 15, 1889. Vice-President and Instructor in Mathematics, September, 1896. Head of Department of Mathematics, September 13, 1899. Vice-Principal, June 21, 1901. Acting Vice-Principal, September, 1904.

John W. Saville, P. A. Eng., U. S. N. (retired), Principal and Instructor in Steam Engineering, September, 1890. President and Instructor in Steam Engineering, May, 1893. Resigned, August 31, 1899.

Edward S. Kines, B. C. C., '90, Assistant Instructor in Academic Department, September, 1890. Resigned, October 1, 1894.

J. Henry Laessig, Assistant to Principal and Instructor in Mechanical Drawing, September, 1890. Resigned, June 30, 1893.

Eason Lewis, Lieut., U. S. A., Instructor in Military Drill and Assistant Instructor in Academic Department, November, 1890. Recalled to U. S. Army, April, 1891.

Albert McClean, Instructor in Forge Work, September, 1891. Resigned, January, 1898.

Warren S. Seipp, B.M.T.S., '91, Instructor in Free-hand Drawing, September, 1891. Instructor in Free-hand Drawing and Carpentry, November, 1901. Instructor, Manual Training Centre No. 1, June, 1902. Instructor in Drawing, Carpentry and Sheet Metal Work, September, 1903. Instructor in Drawing, September, 1904. Instructor, Department of Engineering, September, 1906.

B. Wheeler Sweany, Instructor in Mechanical Drawing, September, 1892. Transferred to Baltimore City College as Professor of Drawing, October 1, 1897.

Joseph F. McBee, Assistant Instructor in Academic Department, September, 1893. Transferred to be Principal of Annex School No. 14, June, 1894. Re-transferred to the Baltimore Polytechnic Institute as Assistant Instructor in Academic Department, January, 1899. Dismissed, May, 1899.

Nathaniel D. D. Sollers, Assistant Instructor in Academic Department, September, 1893. Resigned, June, 1894.

F. D. J. Kaessmann, Assistant Instructor in Academic Department, September, 1893, until September, 1901.

William A. Jones, Assistant Instructor in Sheet Metal Department, September, 1894. Instructor in Sheet Metal Department, September, 1898. Instructor in Forge and Sheet Metal Work, September 17, 1900. Resigned, September 1, 1906.

Samuel M. North, B.C.C., '87, Assistant Instructor in Academic Department, September, 1894. Instructor in Academic Department, September, 1898. Head of Department of English, September 13, 1899. Head of Department of English, including History and Language, June 21, 1901. Head of Department of English and Modern Languages, September, 1906.

Joseph C. O'Conor, Assistant Instructor in Carpentry, September, 1894. Resigned, June 30, 1897.

Henry Sanders, Instructor in Sheet Metal Department, September, 1894. Resigned, November 30, 1894.

William S. Blake, B.C.C., '94. Assistant Instructor in Academic Department, October 1, 1894. Transferred to Male Grammar School No. 1, January, 1899.

Ralph L. Williams, B.P.I., '93, Assistant Instructor in Academic Department, October 1, 1894. Lost at sea, July 4, 1898.

Frederick W. Wild, Instructor in Sheet Metal Department from December 1, 1894, to September 17, 1900.

B. Harrison Branch, B.M.T.S., '92, Assistant Instructor in Academic Department and Assistant in Machine Department, October, 1896. Resigned, April, 1898.

Samuel P. Platt, Instructor in Mechanical Drawing and Descriptive Geometry, October 1, 1897.

J. C. Mattoon, B.M.T.S., '90, Assistant Instructor in Academic Department, November 1, 1897. Resigned, February, 1898.

Oliver Bachrach, B.C.C., '97, Instructor in Academic Department, April, 1898. Instructor in Mathematics, September 16, 1901.

William P. Gundry, B.M.T.S., '90, Assistant Instructor in Academic Department, April 1898. Resigned, December 31, 1901.

J. Edward Broadbelt, B.M.T.S., '90, Ph.G., Maryland College Pharmacy, 1903; Assistant Instructor in Academic Department, September, 1898. Secretary and Instructor in Science, September 16, 1901.

Harry R. Ruse B.P.I., '98, Assistant Instructor in Academic Department from January, 1899, to September 17, 1900.

John H. DeValin, Instructor in Forge Work from September, 1898, to September 17, 1900.

William R. King, Passed Assistant Engineer, U. S. N. (retired), U. S. N. A., '75, President and Instructor in Engineering and Applied Mechanics, September 1, 1899. Principal and Head of Department of Engineering, June 12, 1901.

John H. Bramble, B.C.C., '97, Assistant Instructor in Academic Department, October, 1899. Assistant Instructor in Mathematics and Science, September 16, 1901. Instructor in Mathematics, September 15, 1902.

John Montgomery Gambrill, B.P.I., '97, Instructor in History, Civics, and Literature, June 11, 1902. Resigned to become Assistant State Superintendent of Education in Maryland, July, 1904. Head of Department of History and Civics September, 1906.

Charles Ernest Conway, B.P.I., '02, Assistant in Department of Engineering and Applied Mechanics, June 11, 1902. At Lehigh University, 1903-1904. Assistant in the Department of Engineering and Applied Mechanics, 1904-1905. Resigned, September, 1905.

George P. VonEiff, B.P.I., '02, Assistant in Department of Science, September, 1903. Resigned, June, 1904.

William L. DeBaufre, B.P.I., '03, Assistant in Department of Engineering and Mathematics, September, 1903. At Lehigh University, 1904-1905. Assistant in Department of Engineering, 1905-1906. At Lehigh University, 1906-1907.

Irving L. Twilley, A.M., Washington College, '92, Instructor in Department of English, September, 1903. Transferred to the Department of Science as Instructor in Physics and Physical Geography, June, 1904.

Henry A. Converse, A.B., Hampden-Sidney College, 1893; Ph.D., Johns Hopkins University, 1903; Instructor in Mathematics, May, 1904. Resigned, September 1, 1906, to accept the Chair of Mathematics at Davis and Elkins College.

Edward Reisler, A.M., Western Maryland College, '88, Instructor in History, Civics, and Composition, May, 1904.

Elmer M. Harn, A.B., Rock Hill College, 1892; A.M., Rock Hill College, 1895. Instructor in History, Literature, and Composition, July, 1904. Instructor in Literature and Composition, September, 1905.

Isaac L. Otis, A.B., New York University, 1899, Instructor in Literature and Composition, September, 1904. Instructor in Composition and History, September, 1905.

Harry M. Mason, B.P.I., '04, Assistant in Department of Science, September, 1904, Resigned, June, 1905.

Allen L. Malone, B.P.I., '02; at Cornell University, 1902-1903 and 1903-1904. Instructor in Engineering Materials and Forge Work, October 1, 1904.

Rowland Watts, A.B., Washington College, 1886; A.M., Washington College, 1888. Instructor in Physics and Physical Geography, September, 1905.

Charles C. Grove, A.B., Pennsylvania College, 1900; A.M., Pennsylvania College, 1903. Instructor in Mathematics, Septemper, 1905. Resigned September 1, 1906.

Edwin L. Wilson, B.P.I., '05, Assistant in Department of Science, September, 1905. Resigned, September 1, 1906.

Allan B. Souther, B.S., Harvard, '97, Instructor in Mechanical Drawing and Machine Work, October, 1905.

John W. Dorsey, B.P.I., '05, Assistant in Department of Engineering, September, 1905. At Lehigh University, 1905-1906. Assistant in Department of Engineering, 1906-1907.

Willis B. Clemmitt, B.P.I., '06, Assistant in Department of Science, September, 1906.

Harvey S. Houskeeper, A.B., Lehigh, '72, Instructor, Department of Mathematics, September, 1906.

Henry Bogue, Jr., A.B., Johns Hopkins, '99, Instructor Department of Engineering, September, 1906.

Thomas F. Garey, Jr., A.B., Washington College, '04, Instructor, Department of Mathematics, November, 1906.

Joseph E. Garabrant, M.E., Cornell, '06, Instructor, Department of Engineering, November, 1906.

BOARD OF SCHOOL COMMISSIONERS.

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MENDES COHEN.

SUPERINTENDENT OF PUBLIC INSTRUCTION.

JAMES H. VAN SICKLE.

CALENDAR FOR SCHOOL YEAR 1906—1907.

September 17, Monday	Opening of Session.
November 23, Friday	First Quarter ends.
November 26, Monday	Second Quarter begins.
November 29, Thursday	Thanksgiving Vacation begins.
December 3, Monday	Session resumes.
December 21, Friday	Christmas Vacation begins.
January 3, Thursday	Session resumes.
February 4, Monday	Semi-Annual Examinations begin.
February 15, Friday	Second Quarter ends.
February 18, Monday	Third Quarter begins.
February 22, Friday	Washington's Birthday.
March 28, Thursday	Easter Vacation begins.
April 2, Tuesday	Session resumes.
April 5, Friday	Third Quarter ends.
April 8, Monday	Fourth Quarter begins.
April ——	Arbor Day.
May 13, Monday	Annual Examinations begin.
May 30, Thursday	Decoration Day.
June 18, Tuesday	Commencement Day.
September 16, Monday	Opening of Session.
November 22, Friday	First Quarter ends.
November 25, Monday	Second Quarter begins.
November 28, Thursday	Thanksgiving Vacation begins.
December 2, Monday	Session resumes.
December 23, Monday	Christmas Vacation begins.

FACULTY.

WILLIAM R. KING, U. S. N., *Principal*,
Head of Department of Engineering.

RICHARD H. UHRBROCK, Ph. B., *Acting Vice-Principal*,
Head of Department of Mathematics.

WILLIAM H. HALL, A. M.,
Head of Department of Science.

SAMUEL M. NORTH,
Head of Department of English and Modern Languages.

J. MONTGOMERY GAMBRILL,
Head of Department of History and Civics.

STAFF.

JOHN WARD WILLSON, M.D.,
German and French.

SAMUEL P. PLATT,
Mechanical Drawing and Descriptive Geometry.

OLIVER BACHARACH,
Mathematics.

JOHN H. BRAMBLE,
Mathematics.

JOHN EDWARD BROADBELT, Ph.G., *Secretary*,
Chemistry and Electricity.

IRVING L. TWILLEY, A.M.,
Chemistry and Physics.

EDWARD REISLER, A.M.,
English and History.

ELMER M. HARN, A.M.,
Literature and Composition.

ISAAC L. OTIS, A.B.,
Literature and Composition.

ROWLAND WATTS, A.M.,
Physics.

ALLAN B. SOUTHER, B.S.
Mechanical Drawing.

JOHN W. DORSEY, JR.,
Engineering.

HARVEY S. HOUSKEEPER, A.B.,
Mathematics.

HENRY BOGUE, JR., A.B.,
Mechanical Drawing.

THOMAS F. GAREY, JR., A.B.,
Mathematics.

WILLIS B. CLEMMITT,
Graduate Assistant in Science.

MECHANICAL DEPARTMENT.

WILLIAM G. RICHARDSON,
Machine Work and Engineering Materials.

JOSEPH E. GARABRANT, M.E.,
Engine and Boiler Testing and Pattern-Making.

GEORGE M. GAITHER,
Carpentry and Wood-Carving.

ALLEN L. MALONE,
Engineering Materials, Machine and Forge Work.

WARREN S. SEIPP,
Forge and Sheet Metal Work.

COURSE OF STUDY AND GENERAL STATEMENT OF PLAN AND PURPOSE.

The course of study for the Baltimore Polytechnic Institute is designed to accomplish the following purposes:

1. To give a sound fundamental education to pupils whose inclinations and other circumstances preclude a college course.

2. To give to youth that healthful and highly valuable manual training which broadens education, and conduces to dexterity, contrivance, and invention.

To this end the time usually devoted to Greek and Latin is employed, during two years of the course, in carpentry, sheet-metal, and light forge exercise. These exercises cover what is known as Manual Training, and are given with special reference to their educational value.

3. To give to students in the third and fourth years such studies in Mathematics, Physics and Chemistry, and such mechanical exercises in Applied Manual Training as will fit them:

(*a*) For immediate and remunerative employment in the drafting-room, or for engagements in the wide field of civil, mechanical and electrical engineering, where, it is believed, their training will lead to rapid advancement.

(*b*) For entrance to advanced standing into an institution of technology, should a higher technical education be desired.

For the attainment of these objects there is one carefully planned general course of study, no effort being made to specialize until the fourth year, by which time a student will have acquired a considerable degree of practical skill and intimate knowledge in some one of the professions based on mechanical art and applied science that he may have elected to follow. Thus, for example, the student who may, toward the end of the course, elect to follow electrical engineering as a profession, will be afforded special opportunities for laboratory practice in the manipulation of currents, methods of testing, etc. The student who elects to follow mechanical or steam engineering as a life work, studies the elements of the theory of construction and operation of machines, special attention being given to the theory of the steam engine. In the drawing-room he is given elementary work in engine and machine design, and in the shops he does some actual work in engine and machine building.

No attempt is made to teach trades, but the equipment is of such a nature that the instruction given in the shops is designed to be correlative to the work of the class-room, and results are aimed at that will insure success in mechanical pursuits subsequent to graduation. It is believed that instruction in correct methods of using tools, and practical illustrations of how, and for what purpose, things are done, are of more value than mere excellence in hand skill.

Instruction in the English Department is given during the first, second, and third years, and embraces a review of Grammar, with Parsing, Composition, Rhetoric, and Literature. Special effort is made to inculcate sound principals in the choice of words and phraseology, and frequent written exercises in the various kinds of composition are required of the student.

The instruction in German during the second and third years, and in French during the fourth year, is designed to give a reading, rather than a speaking knowledge of these languages, in order to meet entrance requirements of institutes of technology.

In the Department of History and Civics, instruction is given during the first and second years. The course includes about one-half the work prescribed by the Committee of Seven, the first year being devoted to Ancient History and a brief introduction to that of the Middle Ages, and the second year to American History and Civics.

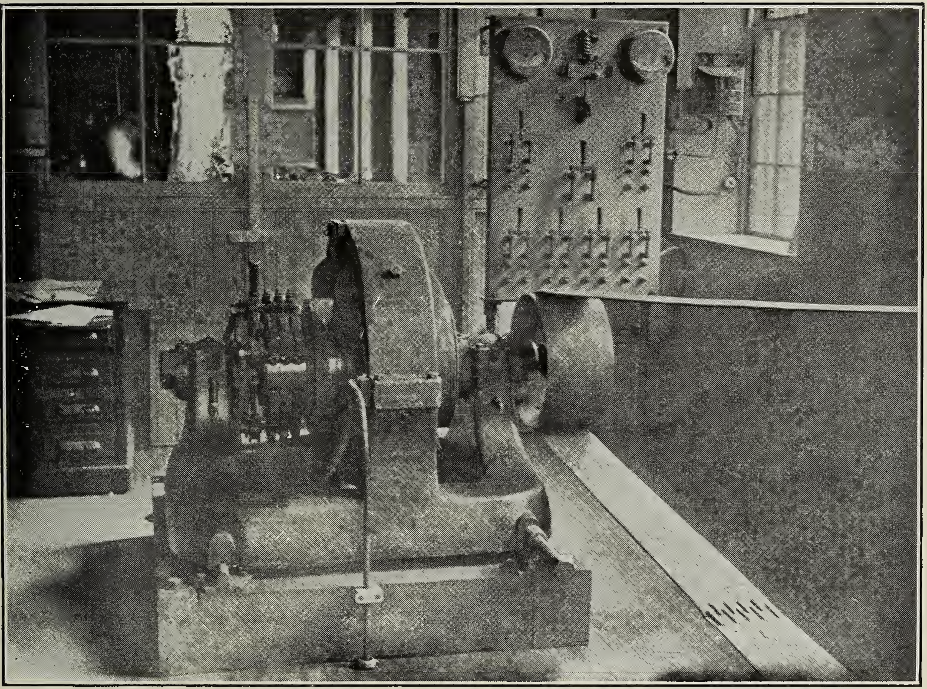
In Mathematics, care is taken at the beginning of the first year to discover and correct any defects in fundamental training, after which the course of instruction proceeds in Algebra, Geometry, Trigonometry, and Analytical and Descriptive Geometry. During the fourth year the instruction given in the Engineering Department in Dynamics and Thermodynamics involves in its very elements the use of equations and mathematical principles which can be understood only by resort to the Calculus. For this reason instruction in the Differential and Integral Calculus is indispensable. The course is sufficiently broad to fit students for more Advanced work, and includes the fundamentals of differentiation and integration, the development of the theorems of Taylor and Maclaurin, and applications of the subject to questions of maxima and minima areas, volumes, and moments of inertia. Without such instruction, a student at graduation will be unable to read understandingly a treatise of any of the mechanical sciences.

In Physics, the work of the first and second years embraces the properties of matter and elementary mechanics, the instruction being accompanied with lectures illustrated by experiments and with practical work in the laboratory. The instruction of third and fourth year students in this subject is confined to Heat and Electricity. The dynamic theory of heat, the conversion of heat into mechanical work, and the thermodynamics of the steam engine are the particular features of the fourth year in the study of Heat.

In Electricity, the work of the fourth year consists of practical applications of the theoretical study of the second and third years, and of commercial electricity. Electric lighting, both arc and incandescent, is discussed from constructive and economic standpoints, especially high and low voltage distribution. The dynamo and motor are treated in detail—operating, designing, and winding being carefully considered. The experimental equipment for this work consists of a twenty-five kilowatt generator, built by the students; a one-half horse power alternating current motor coupled to a twenty-five volt multipolar generator; and several smaller machines of various types. These appliances, with the electric light equipment of the Institute, present opportunities for personal observations and operation of electrical machinery and the various defects and faults to be overcome. Alternating currents are treated both mathematically and experimentally, and converters, motors, impedance coils, and measuring instruments are used by students for verifying laws and descriptions given in lectures. The switchboard and the generator plant afford opportunities for power-station practice, and the electric railway is treated in a practical manner. The newest and best methods of telegraph and telephone construction are presented, the telephones of the Institute being installed on the central-energy plan. Special features of the course are the various tests for insulation resistance of conductors, the tests for grounds, faults and short circuits on lines, and the treatment of the defects in the dynamo and motor, and remedies therefor.

For the study of Chemistry there are chemicals and apparatus in the laboratory to give to the third year students instruction concerning the nature and reactions of the chemical elements and their compounds, and to students of the fourth year a brief course in qualitative and quantitative analysis, the compounds formed in the various reactions and their chemical equations being particularly emphasized.

In the Department of Engineering, the instruction given the fourth year students in theoretical and applied mechanics, which extends well into the Sophomore year of an institute of technology, embraces the laws of equilibrium and motion; centre of gravity; friction; principles of work; moments of inertia; mechanics of materials; and an elementary study of the stresses and deformations produced in standard specimens of metals when subjected to tension, compression, and shearing. The work of the third and fourth year students in steam engineering consists of the study of thermodynamics of the steam engine in as comprehensive a manner as the facilities of the Institute and the maturity of the students permit. Numerous calculations are made involving engine and boiler efficiencies and proportions, and the study of the indicator is supplemented with practice in taking diagrams, from which the consumption and distribution of the steam, and the power of the engine, are determined. The advantages and disadvantages of the different kinds of steam boilers are studied, particular attention being given to such attachments as separators, feedwater heaters, and mechanical stokers. The plant for this work consists of an inverted triple expansion engine of 100 I. H. P., an inverted compound engine of 60 I. H. P., a high speed automatic cut-off engine (Harrisburg standard) of 46 I. H. P., a horizontal power engine of 25 I. H. P., a Campbell & Zell sectional boiler (rated at 100 horse-power), and a Roberts safety water tube boiler, capable of generating steam for the production of 120 I. H. P. when used in connection with the triple expansion engine. The engines mentioned above were built by the students, the first two after designs of the Bureau of Steam Engineering of the Navy Department. Grouped in the mechanical laboratory are all the engines, the 25 K. W. generator, the switchboard controlling the lighting installation of the Institute, and a Riehle testing machine of 50,000 pounds capacity. The compound and triple expansion engines may be worked singly or together in connection with a friction dynamometer especially designed at the Institute, an internal circulation of water in the brake wheel enabling the engine to run continuously in making power tests. The Roberts boiler is installed in a room immediately connected with the laboratory, and furnishes steam at 150 pounds pressure per square inch for the stage expansion engines, and at 95 pounds and 40 pounds to the high speed and power engines, respectively, Foster regulators reducing the pressure as desired. Horizontal and vertical separators are placed in the steam pipes to insure the delivery of dry steam to the engines, and connections are made for calorimeter tests. The surface condenser used in connection with the stage expansion engines may also be connected with the exhaust of the high-speed engine when desired. The water from condensation is delivered to a filter of approved design by a Knowles independent air pump, and thence direct to the boiler, either by a Dean pump or Penberthy injector. Exhaustive engine and boiler tests for power and efficiency are made by squads of ten of the senior class, the results of which are recorded in standard forms and retained by the students.



DYNAMO AND SWITCHBOARD, MECHANICAL LABORATORY.

In the mechanical drawing-room are ninety-five tables of approved design, and an equipment of instruments and models well adapted to the requirements of an advanced course in the subject. Third-year students are required to make a free-hand sketch of the parts of some machine, from which a finished drawing, tracing, and blue print are made. The work of the fourth-year students in machine design tends to make them draftsmen in the true sense—not mere copyists.

The material equipment in the machine, pattern, forge, sheet metal, and carpentry shops is equal, and in some respects superior, to that of any similar institution in the country.

THE COURSE OF INSTRUCTION IN DETAIL.

A yearly course extends over the usual period of ten months, but after deducting holidays and the time allotted to examinations it is found that not more than thirty-two effective weeks remain for instruction.

Students completing the course as here outlined obtain full Sophomore standing with some Sophomore credits in the courses leading to the degrees of C. E., M. E. and E. E. at Cornell and Lehigh universities.

DEPARTMENT OF ENGINEERING AND APPLIED MECHANICS.

FIRST YEAR COURSE—D CLASS.

Lectures and Practical Exercises.

(*a*) *Carpentry.*—16 weeks, 4 periods a week.

(*b*) *Sheet Metal.*—16 weeks, 4 periods a week.
Soldering ; sheet metals ; Venetian iron and repousse work.

(*c*) *Mechanical Drawing.*—32 weeks, 4 periods a week.
Use of instruments ; lettering ; elementary lessons.

SECOND YEAR COURSE—C CLASS.

Lectures and Practical Exercises.

(*a*) *Review of Carpentry.*—4 weeks, 4 periods a week.

(*b*) *Introductory Vise Work.*—8 weeks, 4 periods a week.

(*c*) *Forge.*—8 weeks, 4 periods a week.
Light forging and welding.

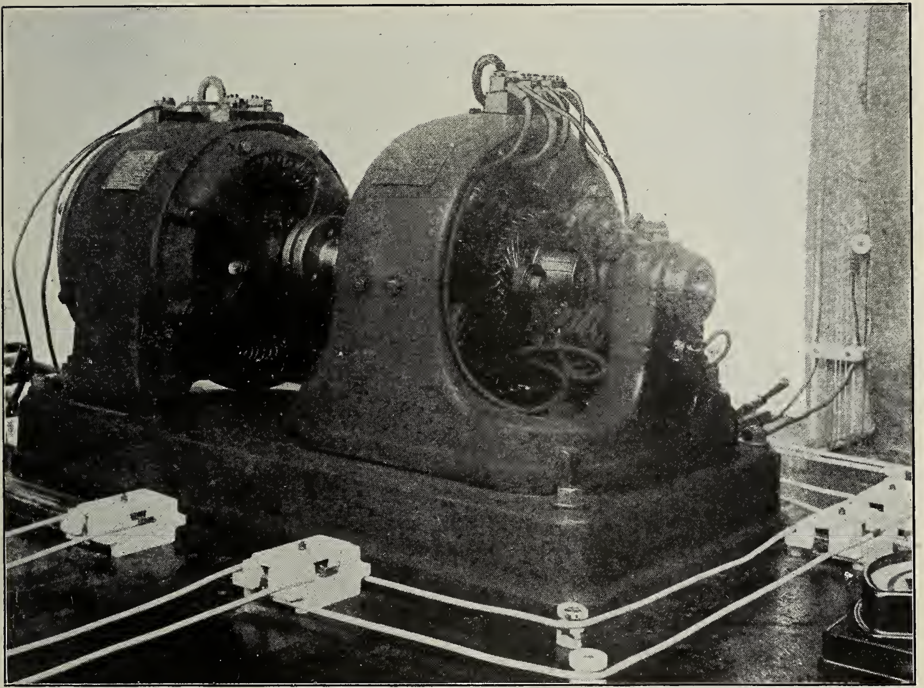
(*d*) *Pattern.*—12 weeks, 4 periods a week.

(*e*) *Mechanical Drawing.*—32 weeks, 5 periods a week.
Hatching; tinting; neatness and accuracy; scale drawing.
Intersection and development of surfaces.

THIRD YEAR COURSE—B CLASS.

Steam Engineering.—32 week, 4 periods a week.

Types of boilers; boiler details; boiler room auxiliaries; the steam engine; engine details; indicating and governing; governors; valves condensers; multiple expansion engines; properties of perfect gasses; properties of saturated steam; use of steam tables; fuels; combustion of



WESTINGHOUSE MOTOR GENERATOR.

USED IN LABORATORY.

fuel and steam generation; boiler and engine efficiencies; the engine mechanism; slide valve and link motion.

Mechanical Drawing.—32 weeks, 4 periods a week.

Detail drawings of machines from free-hand sketches; the working drawing, tracing and blue print. Descriptive Geometry (see course in Mathematice).

Practice.—(*a*) Pattern Shop; 16 weeks, 4 periods a week.

Exercises in making patterns for wrenches, pulleys, eccentrics, pillow-blocks, gears, globe valves, pipe joints and core boxes where necessary.

Lectures on construction and finish of patterns; green sand molding, open sand molding, loam molding, mixing of iron and of brass, and on the operation of the cupola.

(*b*) Machine Shop, Forge Shop, and Laboratory; 16 weeks 4 periods a week.

Work on the lathe, planer, milling machine, drill-press, and vice. Forging and tempering machine cutting tools; casehardening; chasing. Operating engines and taking indicator diagrams.

FOURTH YEAR COURSE—A CLASS.

Steam and the Steam Engine.—32 weeks, 3 periods a week.

The indicator and the indicator diagram; measurement of power and of steam consumption; expansion of perfect gases and of steam; the ideal and the actual engine; engine and boiler design; valve diagrams; engine and boiler testing; the steam turbine.

Mechanics.—32 weeks, 4 periods a week.

First Principles.—Matter; mass; inertia; velocity; acceleration; force; absolute measure of force; gravity; gravitation units of measure; comparison of gravitation and absolute measure of force.

Kinematics.—Motion in a straight line with a constant acceleration; falling bodies; resolution and composition of velocities; the conversion of motion; harmonic motion; velocity ratios.

Dynamics. — (*a*) Statics.—The parallelogram, triangle, and polygon of forces; composition and resolution of forces; conditions of equilibrium; transmissibility of force; parallel forces; moments of forces and of couples; conditions of equilibrium of a body under the action of three forces in one plane; centre of gravity; friction; virtual velocities; the mechanical powers. (*b*) Kinetics.—The laws of motion; centripetal and centrifugal forces; kinetic energy, or vis viva, of a moving body; impulsive forces; direct and oblique collision of bodies; work.

Mechanics of Materials.—Stress; strain; elastic limit; ultimate strength; bending and resisting moments; moment of inertia; radius of gyration; simple and cantilever beams; struts; deflection; torsion; resilience; bending-moment and shear diagrams.

Graphic Statics.—The funicular polygon; the reciprocal diagram for determining stresses in strained structures.

Mechanics of Machinery.—Transmission of power by means of belts and toothed-gears; theory and action of pumps. Kinematics.—Velocity diagrams; toothed-gears; couplings; belt gearing; cams; parallel and straight-line motions.

Design and Mechanical Drawing.—32 weeks, 4 periods a week.

Design.—Proportioning of machine parts, such as spur, bevel, and worm gearing, belt pulleys, and bearings, from empirical and rational formulas. The application of the mechanics of materials to the design of some part of an engine or of a tool, such as cylinder, connecting rod, valve, screw jack. The Zeuner Diagram.

Mechanical Drawing.—The drafting accompanying the work in design; free-hand sketches, working drawings, tracings, and blue prints.

Practice.—32 weeks, 2 periods a week.

Actual running and indicating of steam engines; valve setting; testing for tension, compression, and flexure with a Riehle machine; machine work involving accuracy and finish; economy tests of engines and boilers; calorimeter tests for quality of steam.

DEPARTMENT OF MATHEMATICS.

FIRST YEAR COURSE—D CLASS.

Algebra.—32 weeks, 4 periods a week.

Definitions and notation; fundamental operations; integral linear equations; factoring; highest common factor; least common multiple; fractions; fractional equations; simultaneous linear equations; graphical representation; inequalities; involution; evolution; theory of exponents; surds; quadratic equations.

Geometry.—32 weeks, 3 periods a week.

Geometry of the straight line and circle; proportion; properties of similar figures; original exercises.

Explanation and Demonstration—32 weeks, 2 periods a week.

The most difficult and important features of the course are explained and demonstrated.

SECOND YEAR COURSE—C CLASS.

Algebra.—16 weeks, 3 periods a week, and 16 weeks, 2 periods a week.

Review of involution, evolution, theory of exponents, surds, and of quadratic equations; theory of quadratic equations; variables and limits; indeterminate equations; ratio and proportion; logarithms.

Geometry.—16 weeks, 3 periods a week, and 16 weeks, 1 period a week.

Areas of polygons, regular polygons, and of circles; lines and planes in space; polyhedrons; cylinder; cone; original exercises.

Trigonometry.—16 weeks, 3 periods a week.

Functions of the acute angle; the right triangle; use of tables; functions of any angle; relations between the functions of several angles; inverse trigonometric functions.

THIRD YEAR COURSE—B CLASS.

Algebra.—6 weeks, 3 periods a week.

Variation; arithmetical, geometrical, and harmonic progressions; binomial theorem; undetermined coefficients.

Geometry.—6 weeks, 3 periods a week.

The sphere; problems and original exercises.

Trigonometry.—10 weeks, 3 periods a week.

General Formulas; oblique triangle; miscellaneous examples.

Surveying—10 weeks, 3 periods a week.

Instruments and their uses; land surveying.

Analytic Geometry.—32 weeks, 4 periods a week.

The straight line; circle; parabola; ellipse; hyperbola; transformation of co-ordinates; construction of loci; higher plane curves.

Descriptive Geometry.—Time taken from mechanical drawing, as the subject is taught in conjunction with that subject.

Projections; problems in straight line and plane; projections and sections of solids; curved surfaces and tangent planes; development and projection of screw threads; intersection of surfaces.

FOURTH YEAR COURSE—A CLASS.

Differential and Integral Calculus.—32 weeks, 5 periods a week.

Differentiation of algebraic and of transcendental functions; successive differentiation; expansion of functions, including the development of Maclaurin's and of Taylor's Theorems; evaluation of indeterminate forms; mode of variation of functions of one variable, including geometric problems in maxima and minima; differentiation of functions of more than one variable; tangents and normals; derivatives of arcs, areas, volumes, and surfaces of revolution; circle of curvature; radius of curvature; fundamental rules and methods of integration; geometrical applications of the calculus to lengths of curves, to areas, to volumes of solids of revolution; integration of trigonometric functions; successive integration; applications to mechanics.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

FIRST YEAR COURSE—D CLASS.

General Physics.—32 weeks, 2 periods a week.

Properties of matter; C. G. S. units; falling bodies; work and power; elementary mechanics; specific gravity; elements of hydromechanics; pressure and expansion of air; lectures illustrated by experiments.

Physical Geography.—32 weeks, 2 periods a week.

The subject is taught by lectures, demonstrations, and recitations, the relation between physiographic conditions and commercial and agricultural products being emphasized.

SECOND YEAR COURSE— C CLASS.

General Physics.—32 weeks, 4 periods a week.

Sound.—Nature, intensity and propagation; sound waves; pitch; quality; reinforcement.

Heat.—Thermometers; calorimetry; coefficients of expansion; boiling points; distillation; latent heat; laws of thermodynamics; mechanical equivalent of heat.

Light.—Nature, sources, and propagation; reflection; refraction; dispersion; polarization; interference; lenses: optical instruments.

Electricity.—Magnetism; currents; induction; static electricity; general study of the applications of electricity.

Problems and practical work in laboratory.

THIRD YEAR COURSE—B CLASS.

Electricity.—32 weeks; 3 periods a week.

Deduction of formulæ; use of galvanometers; magnet testing; laws of induction; simple alternating currents; relation of electricity to work and power; practical work in laboratory.

Chemistry.—32 weeks, 2 periods a week.

Recitations in general chemistry; experiments illustrating text.

FOURTH YEAR COURSE—A CLASS.

Electricity.—32 weeks, 4 periods a week.

Lectures and recitations in applied electricity, including electrochemical action; principles of the dynamo, motor, and transformer; railways; line and machine testing; telegraph and telephone; electric lighting; practical work in laboratory.

Chemistry.—32 weeks, 4 periods a week.

Theory of analysis; qualitative analysis of solutions containing one base and one acid; qualitative analysis of solutions containing several salts; qualitative analysis of powders; quantitative analysis of silver, ammonia, and iron solutions by volumetric method; quantitative analysis of solutions for barium and phosphoric acid by gravimetric method; simple determinations of carbon, sulphur; manganese, and silicon, in iron and steel.

DEPARTMENT OF ENGLISH AND MODERN LANGUAGES.

FIRST YEAR COURSE—D CLASS.

English Grammar.—16 weeks, 2 periods a week.

Review of grammar; parsing.

Composition and Rhetoric.—32 weeks, 2 periods a week.

Study of text and frequent written exercises based upon Narration and Description; Letter Writing.

Literature.—32 weeks, 3 periods a week.

(a) Study of the following selections: Legend of Sleepy Hollow, Tales of White Hills, The Gold Bug, The Forest Hymn, Snow Bound, Vision of Sir Launfal, The Deserted Village, The Lady of the Lake, and The Ancient Mariner.

(b) Leading facts in the lives of the authors represented in (a).

SECOND YEAR COURSE—C CLASS.

Composition and Rhetoric.—32 weeks, 2 periods a week.

Frequent written exercises; study of rhetorical principles.

Literature.—32 weeks, 3 periods a week.

(a) Study of the following texts: Vicar of Wakefield, Ivanhoe, Silas Marner, Sir Roger de Coverly, Palgrave's Golden Treasury (in part), Merchant of Venice.

(b) Leading facts in the lives of representative English writers since Pope's time.

German.—32 weeks, 3 periods a week.

Study of the grammar and reading.

THIRD YEAR COURSE—B CLASS.

Literature.—32 weeks, 3 periods a week.

Study of the texts of Macbeth; Paradise Lost (Books I. and II.), and of the works prescribed by the Committee on Uniform Entrance Requirements. The texts prescribed for 1908 are: Julius Caesar; Milton's L'Allegro, Il Penseroso, Comus, and Lycidas; Burke's Conciliation with America ; Macaulay's Essay on Addison ; Macaulay's Life of Johnson.

Frequent written exercises.

German.—32 weeks, 3 periods a week.

Composition ; grammar ; reading easy scientific prose.

FOURTH YEAR COURSE—A CLASS.

French.—32 weeks, 4 periods a week.

Study of the grammar ; composition ; reading simple prose science.

DEPARTMENT OF HISTORY AND CIVICS.

FIRST YEAR COURSE—D CLASS.

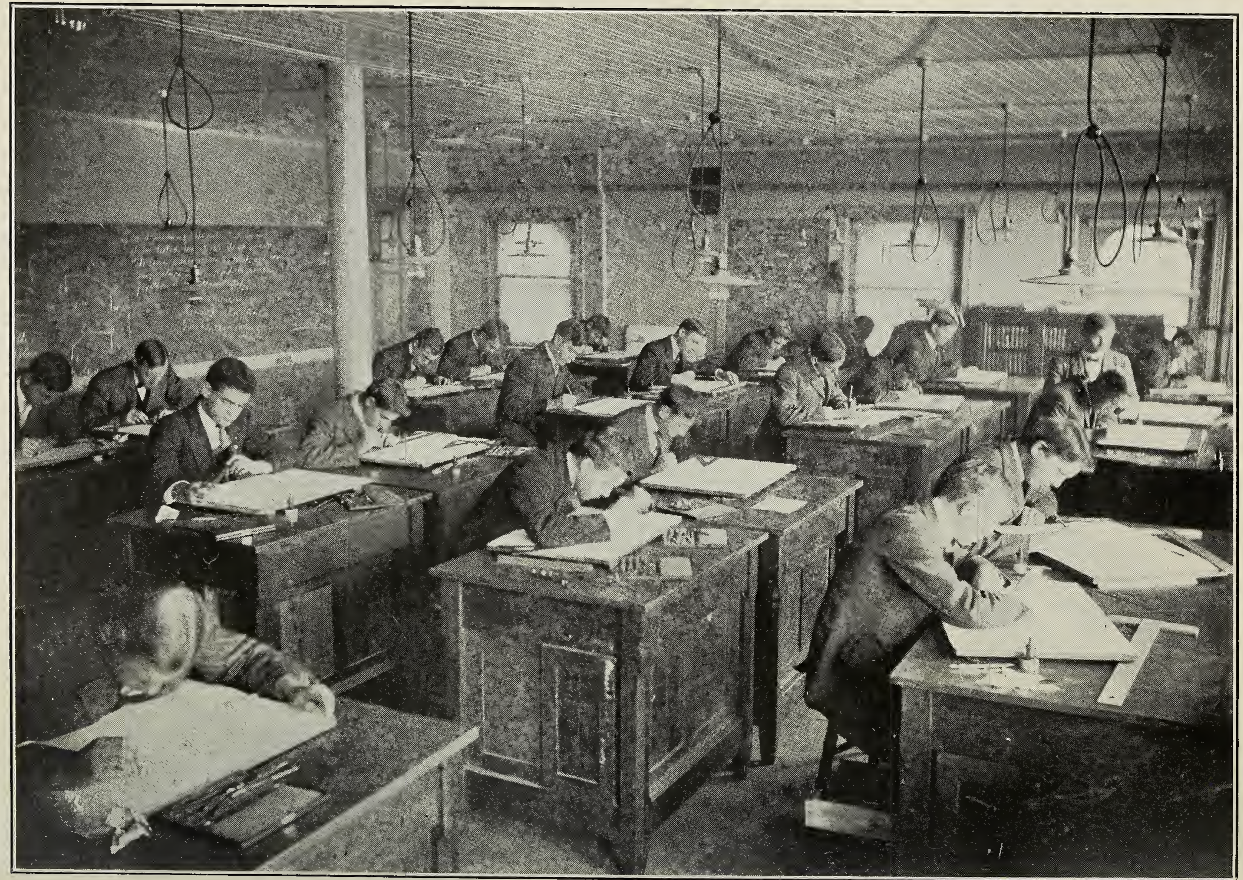
History.—32 weeks, 3 periods a week.

The course includes Greek and Roman History, introduced by a brief account of the ancient Orient and followed by a sketch of the opening of the Middle Ages to Charlemagne ; especial attention is devoted to the contributions of the ancient world to modern civilization.

SECOND YEAR COURSE— C CLASS.

History and Civics.—32 weeks, 3 periods a week.

American History, with special attention to political development ; civil government in the United States and the rights and duties of American citizenship.



SENIOR CLASS, MACHINE DESIGN.

TIME DEVOTED TO THE DIFFERENT SUBJECTS COMPRISING THE FOUR YEAR COURSE.

	NUMBER OF HOURS PER YEAR.				
	1st Year.	2nd Year.	3rd Year.	4th Year.	Aggregate.
DEPARTMENT OF ENGINEERING.					
Carpentry	64	16	......	......	80
Sheet Metal	64	......	......	......	64
Vise	......	32	20	......	52
Forge	......	32	20	......	52
Pattern	......	48	64	......	112
Machine	......	......	24	24	48
Mechanical Laboratory	......	......	......	40	40
Mechanical Drawing	128	160	96	......	384
Descriptive Geometry	......	......	32	......	32
Machine Design	......	......	......	128	128
Steam Engineering	......	......	128	96	224
Mechanics	......	......	......	64	64
Mechanics of Materials	......	......	......	64	64
DEPARTMENT OF MATHEMATICS.					
Algebra	160	80	18	......	258
Geometry	128	64	18	......	210
Geometry, Analytic	......	......	128	......	128
Trigonometry	......	48	30	......	78
Trigonometry, Surveying	......	......	30	......	30
Calculus, Differential	......	......	......	80	80
Calculus, Integral	......	......	......	80	80
DEPARTMENT OF SCIENCE.					
Physical Geography	64	......	......	......	64
Physics	64	96	......	......	160
Physics, Laboratory	......	32	......	......	32
Electricity	......	......	64	96	160
Electricity, Laboratory	......	......	32	32	64
Chemistry, Elementary	......	......	32	*96	32
Chemistry, Laboratory	......	......	32	*32	32
Chemistry, Analytic	......	......	......	128	128
DEPARTMENT OF ENGLISH.					
English Grammar	32	......	......	......	32
Composition and Rhetoric	64	64	......	......	128
Literature	96	96	96	......	288
German	......	96	†96	......	192
French	......	......	......	128	128
DEPARTMENT OF HISTORY & CIVICS.					
History	96	....	......	......	96
History and Civics	......	96	......	......	96
Totals	960	960	960	960	3840

*Students preparing for the Universities receive instruction in Elementary instead of Analytic Chemistry.

†University Students receive 32 hours additional of German.

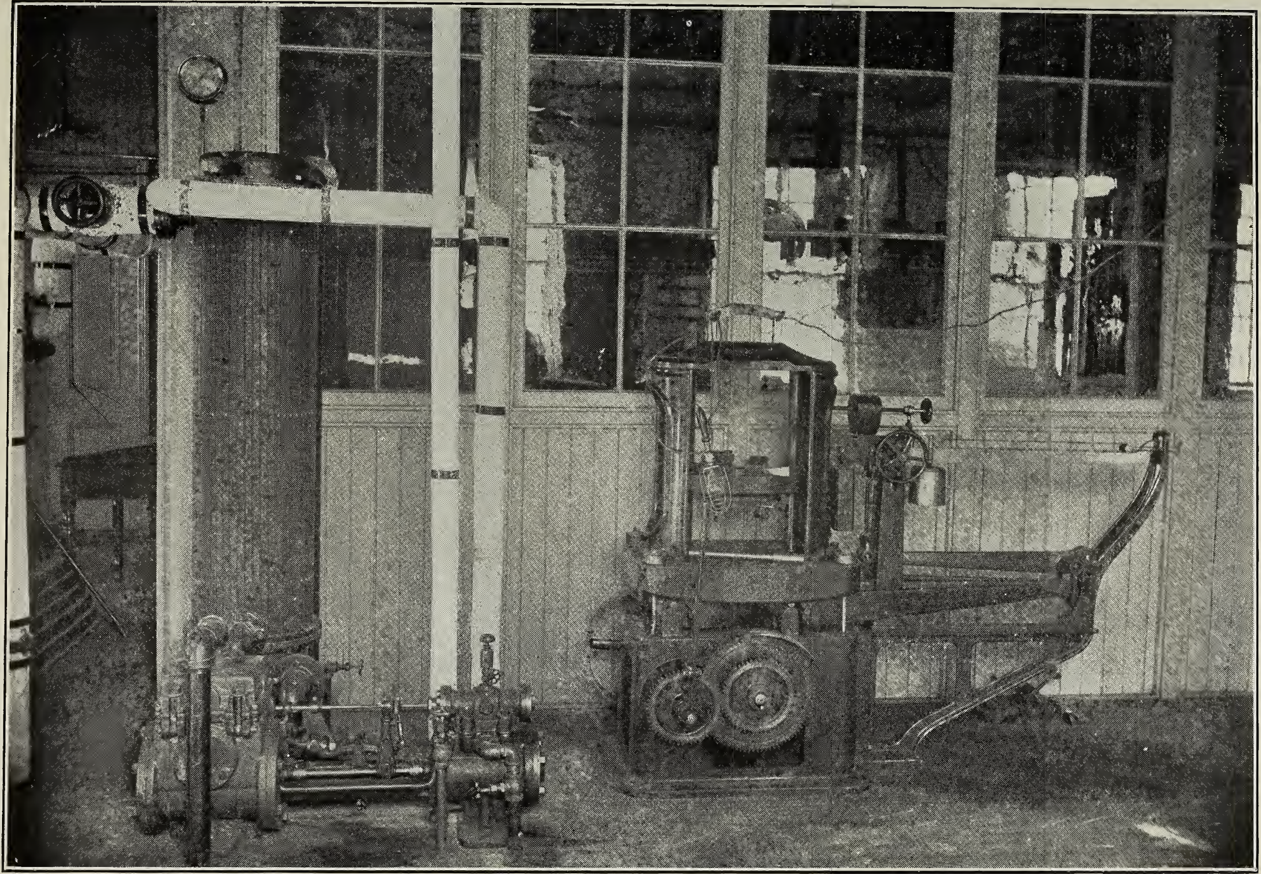
REQUIREMENTS FOR ADMISSION.

Pupils bearing properly attested certificates of having passed the prescribed Grammar School Course of the Public School System of Baltimore are entitled to enrollment.

Other applicants residing in the city will be admitted after passing an examination covering the requirements of the eighth grammar school grade. Eighth grade grammar school pupils who failed of promotion are not eligible for admission under this requirement. Specimen entrance examination papers covering the requirements of the eighth grade will be found on pages 68 and 69.

Non-resident applicants, in addition to passing the entrance examination, are required to pay an annual fee of $72.00, charged for tuition and for the use of books.

After having successfully passed the entrance examination, a non-resident applicant must register as such at the office of the Secretary of the Board of School Commissioners, where he will be furnished with a bill for the first quarterly installment of the fee; and a presentation at the Institute of a coupon from the bill, signed by the City Comptroller, will be accepted as evidence of payment, and entitle the applicant to enrollment.



CONDENSER AND RIEHLE TESTING MACHINE, MECHANICAL LABORATORY.

MERIT ROLLS.

Merit rolls, showing the proficiency of students in each branch of study, are made out annually for the different classes.

Each subject is assigned a coefficient indicative of its relative weight, and the final mark of a student in a subject (on a scale of 100) is multiplied by its coefficient. The sum of the products is the final mark of the student for the year. This mark is a certain percentage of the sum of the coefficients, and such percentage is the student's average for the year.

BALTIMORE POLYTECHNIC INSTITUTE.

Final Merit Roll and Fourth Year Record of Graduating Class of 1906.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for four years.	Graduating Average.
	MAXIMA.........		**7**	**10**	**10**	**8**	**10**	**10**	**10**	**5**	**. 5**	**5**	**20**	**40**	**60**	**80**	**200**	**100**
27	H. R. Anderson..	1902	5.60	7.10	7.40	6.56	8.00	8.70	8:00	3.65	4.35	4.45	16.97	32.43	49.70	63.81	162.91	81.46
25	M. Appel........	1902	5.60	8.40	7.40	6.40	7.80	8.80	7.70	3.50	4.15	3.15	17.20	33.60	50.38	62.90	164.08	82.04
33	W. K. Bachrach..	1902	5.11	7.40	7.70	6.16	7.40	8.50	8.10	4.10	4.30	4.15	17.13	32.40	48.28	62.92	160.73	80.37
***13**	H. C. Becker.....	1902	5.18	8.10	8.30	6.40	9.30	9.60	8.90	4.70	4.25	5.00	17.47	34.10	53.48	69.73	174.78	87.39
***12§**	J. R. Bolgiano....	1903	5.39	9.00	8.50	6.72	8.80	8.30	8.70	4.20	4.50	5.00	17.79	35.53	52.48	69.11	174.91	87.46
36	W. W. Boyd.....	1902	4.69	7.60	7.30	6.32	7.50	7.70	7.40	3.75	4.15	4.85	17.21	32.47	48.30	61.26	159.24	79.62
39	G. H. Carl.......	1902	5.60	7.30	7.30	5.92	8.10	7.50	7.60	4.05	4.15	1.80	14.40	30.39	45.32	59.32	149.43	74.72
***5**	W. B. Clemmitt..	1902	5.74	9.10	9.10	7.04	9.30	9.10	8.90	4.70	4.50	4.75	18.36	35.89	55.06	72.23	181.54	90.77
***2**	C. H. Dorsey....	1902	6.51	9.80	9.60	7.44	9.60	9.70	9.20	4.90	4.70	5.00	18.92	37.18	56 00	76.45	188.55	94.28
23	G. Erck.........	1902	6.09	7.20	7.10	5.84	8.10	7.50	8.20	3.75	4.40	5.00	16.04	34.59	50.94	63.18	164.75	82.38
***6**	H. C. Fink.......	1902	6.02	9.00	8.70	6.64	9.60	9.60	8.90	3.90	4.45	5.00	18.49	35.89	55.22	71.81	181.41	90.71

BALTIMORE POLYTECHNIC INSTITUTE.

FINAL MERIT ROLL AND FOURTH YEAR RECORD OF GRADUATING CLASS OF 1906.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for four years.	Graduating Average.
	MAXIMA.........		**7**	**10**	**10**	**8**	**10**	**10**	**10**	**5**	**5**	**5**	**20**	**40**	**60**	**80**	**200**	**100**
***18**	E. Friese.........	1902	5.60	8.40	8.20	6.08	8.80	8.30	8.70	4.60	4.45	5.00	17.30	34.28	51.58	68.13	171.29	85.55
***10**	J. R. Guttmann..	1902	5.88	8.50	8.80	6.56	9.40	9.60	8.90	3.60	4.45	5.00	17.18	34.26	54.42	70.69	176.55	88.28
20	J. R. Haswell....	1902	5 25	7.80	8.30	6.72	8.10	8.40	7.90	3.50	4.50	5.00	17.00	34.11	52.00	65.47	168.58	84.29
30	C. W. Henderson	1902	5.39	7.70	7.90	5.84	8.30	8.80	7.90	3.90	4.30	4.65	16.97	32.71	47.76	64.68	162 12	81.06
26	G. F. Heubeck...	1902	5.39	8.20	7.80	6.08	8.50	8.50	8.10	3.85	4.35	5.00	16.85	31.65	48.80	65.77	163.07	81.54
***7**	R Holbrook.....	1902	6.44	8.80	8.40	7.28	9.00	9.60	8.80	4.20	4.45	5.00	18.66	36.79	53.72	71.97	181.14	90.57
34	A. C. Kemler....	1902	5.74	6.90	7.10	6.24	8.10	8.70	8.10	3.65	4.40	5.00	16.80	32.93	49.52	61.29	160 54	80.27
37	H. G. Lanahan ..	1902	4.97	7.70	7.20	5.92	7.70	7.40	7.00	3.95	4.05	4.75	16.34	33.00	47.28	60.64	157.26	78.63
24	G. F. Lehmann..	1902	5.25	7.90	7.70	5.76	8.50	8.90	7.60	4.30	4.15	4.35	17.14	33.73	49.30	64.41	164.58	82.29
***4**	F. T. Leilich.....	1902	6.23	9.50	9.50	7.20	9.50	9.50	9.50	4.60	4.70	5.00	17.41	34.86	54.82	75.23	182.32	91.16
***15§**	H. M. Lewis.....	1903	6.16	8 90	8.60	6.64	8.50	8.90	8.90	3.75	4.30	4.85	17.27	34.43	52.32	69.50	173.52	86.76

BALTIMORE POLYTECHNIC INSTITUTE.

FINAL MERIT ROLL AND FOURTH YEAR RECORD OF GRADUATING CLASS OF 1906.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for four years.	Graduating Average.
	MAXIMA........ ..		**7**	**10**	**10**	**8**	**10**	**10**	**10**	**5**	**5**	**5**	**20**	**40**	**60**	**80**	**200**	**100**
38	B. A. McAbee....	1901	5.88	7.20	7.00	5.68	8.10	8.30	7.50	3.65	4.30	3.70	12.76	33.21	47.38	61.31	154.66	77.33
***11**	C. F. Meyer	1903	6.09	9.10	8.60	7.28	8.50	8.50	8.70	3.80	4.35	4.25	17.00	35.58	53.20	69.17	157.95	87.75
†40	S. D. Mitchell....	1902	5.60	7.30	6.60	6.32	8.10	8.40	7.90	3.55	4.15	3.85	17.30	34.48	49.46	61.77	163 01	81.51
***19**	F. Oppenheimer	1902	5.60	7.60	7.90	6.24	8.20	9.10	8.40	4.50	4.35	4.50	17.61	34.04	52.92	66.39	170.96	85.48
***3**	J. G. Pertsch, Jr..	1902	6.09	9.00	9.20	7.12	9.50	9.20	9.00	4.60	4.55	5.00	18.27	36.63	55.84	73.26	184.00	92.00
***16**	L. W. Porter.....	1902	6.30	8.40	8.20	6.48	9.00	9.10	8.70	4.25	4.35	4.95	17.45	33.65	52.12	69.73	172.95	86.48
***14**	J. T. Ridgely	1902	6.30	9.10	8.70	6.64	8.90	9.00	8.80	4.35	4.60	3.50	17.40	34.43	52.40	69.89	174.12	87.06
22	J. C. Schirmer...	1902	4.62	8.40	8.20	6.08	8.80	9.00	8.20	4.40	4.30	4.45	17.20	32 34	51.04	66.45	167 03	83.52
35	E. K. Stembridge	1902	5.25	7.60	7.10	5.60	7.30	7.70	7.60	3.50	4.30	3.70	17 69	33.97	48.94	59.65	160.25	80.13
31	D. B. Stewart, Jr.	1902	5.67	8.00	7.70	6.08	7.70	8.00	8.90	3.95	4.35	3.75	16.68	31.58	48.90	64.10	161.26	80.63
21	L. H. Stewart....	1902	5.95	8.10	8.00	6.40	7.80	8.60	8.50	4.05	4.40	5.00	17.78	32.43	51.14	66.80	168.15	83.53

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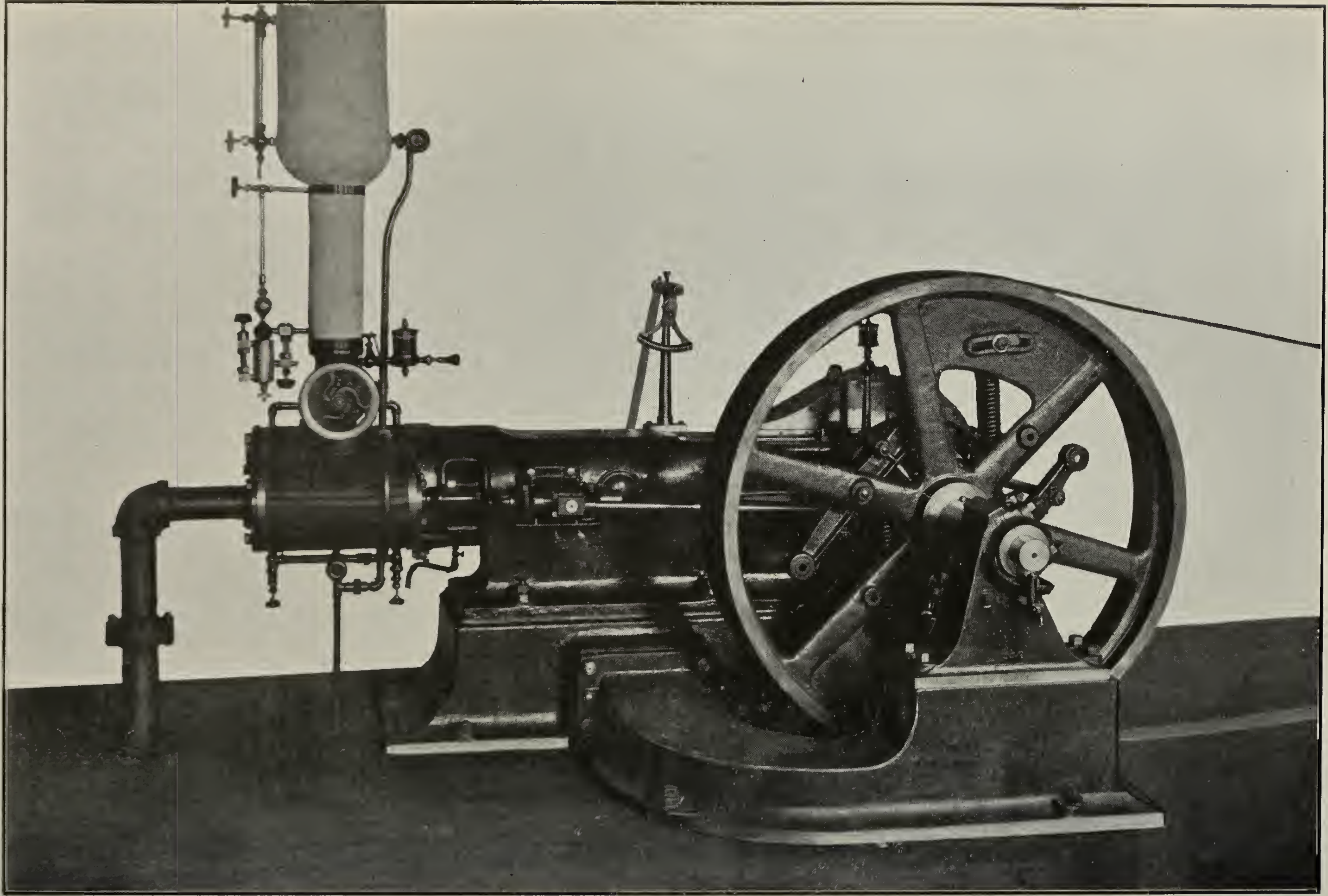
UNIVERSITY OF ILLINOIS



HIGH SPEED AUTOMATIC CUT-OFF ENGINE (HARRISBURG STANDARD).

BALTIMORE POLYTECHNIC INSTITUTE.

FINAL MERIT ROLL AND FOURTH YEAR RECORD OF GRADUATING CLASS OF 1906.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for four years,	Graduating Average.
	MAXIMA.........		**7**	**10**	**10**	**8**	**10**	**10**	**10**	**5**	**5**	**5**	**20**	**40**	**60**	**80**	**200**	**100**
32	I. E. Stolberg....	1902	4.34	7.10	7.20	6.08	7.50	8.00	7.00	3.90	4.05	4.75	17.69	33.29	50.00	59.95	160.93	80.47
28§	F. T. Suman.....	1903	5.32	7.50	7.50	6.32	7.40	9.00	8.60	3.50	4.40	4.90	16.36	34.03	47.88	64.44	162.71	81.36
†41	N. C. Thalheimer.	1902	5.46	7.00	6.30	5.60	7.50	7.70	7.10	4.00	4.05	4.75	16.06	30.73	46.02	59.46	152.27	76.14
***17§**	R. M. Weaver....	1903	5.60	8.60	8.60	6.80	9.20	9.50	8.70	4.55	4.55	4.00	17.25	34.32	50.50	70.10	172.17	86.09
***1**	G. F. Wennagel..	1902	6.51	9.90	9.50	7.44	9.60	9.70	9.20	4.80	4.80	5.00	18.83	37.44	56.56	76.45	189.28	94.64
***8**	G. F. Wieghardt	1902	6.23	8.90	8.90	7.12	9.30	8.10	8.90	3.85	4.75	5.00	17.53	35.76	53.96	71.05	178.30	89.15
29§	P. H. Williamson	1903	5.11	7.60	8.20	6.24	8.20	8.00	8.00	4.35	4.20	3.10	17.18	34.15	47.94	63.00	162.27	81.14
***9**	W. B. Wills.....	1902	6.16	8.60	8.40	6.96	8.80	9.30	8.80	4.25	4.55	4.95	17.40	34.88	53.54	70.77	176.59	88.30

*Received 85% or more of the aggregate multiple for the entire course.
†Deficient in Steam Engineering; allowed a re-examination in September and passed.
§Entered in February, 1903.

ADDRESS

To the Graduating Class of the Baltimore Polytechnic
Institute, by Calvin W. Hendrick, Chief Engineer
Sewerage Commission of Baltimore City.

Academy of Music, June 19, 1906.

Mr. President;
Members of the Graduating Class;
Ladies and Gentlemen:

Your president has asked me to speak to you tonight along the lines of some of the experiences encountered in actual business life. I presume his reason for selecting me was that he has understood I began these experiences very early in life. In giving you the result of them it is with the hope that it may help you to avoid those pitfalls with which we are all constantly surrounded.

When I look into your faces tonight and think of the possibilities of success that lie before you in such a country as this, where such wonderful opportunities are held out to the most humble man or boy, it should make us thankful to realize that our lot has been cast in this "Land of the Brave and Home of the Free." In many countries the boy steps into his father's shoes, be he shoemaker or blacksmith, but in this country the shoemaker's boy may wear the honors of the highest office in the land. This is one of the best living proofs that our educational institutions are the foundations of our national prosperity and brilliant rise to one of the greatest powers of the world in such a remarkably brief period.

Tonight is a milestone in your life that you are just passing. As you leave this hall put your diploma with your kit of tools and consider it an asset, and as you press forward do not be constantly looking back on the milestone you pass tonight. Keep your eyes straining ahead to see the next one. Many a "first honor" man has stumbled and fallen as he pressed along the high road of life, because of looking back and trusting to his diploma to carry him through. A diploma is, indeed, a valuable asset, and the man with one has often a great advantage in the struggle of life over the one who has none, provided he uses common sense, energy and perseverance along with it.

Few people realize the responsibilities that rest upon technical men, be they engineers or of other professions. They are the pioneers of civilization, being the first to penetrate new and unexplored fields. Nothing is done or contemplated in the way of improvements until they are first called in, and upon their advice depends success or failure. When you stop to think of the untold wealth spent each year by them on projects of various kinds, you then begin to realize the important part they play in making history. Often they do not get the credit which belongs to them, especially those men who are devoted to their profession and whose main object always is the success of an undertaking. They are compelled to bury themselves in their work, which is often in isolated places, entirely removed from the stage on which the public has its attention concentrated, spending their days and nights in hard labor under all kinds of conditions, and often at a salary which an ordinary business man would not consider for a moment. I trust the day is fast coming when they will be appreciated more than they have been in the past.

There is more honor among men than they are usually given credit for. I know that this holds good as to engineers, who are often placed in positions where their word means the making or breaking of men and firms, and these positions give them opportunities to make large sums of money by simply a yes or a no. To their credit, be it said that you rarely see an engineer who has made a fortune in his profession, which speaks for itself. I do not mean to convey the idea that it casts a shadow on an engineer to be rich, but it goes to show that engineers are usually so absorbed in studying and carrying out their schemes that the successful outcome of an undertaking means more to them than the accumulation of dollars and cents.

When it is realized what privations they are compelled to undergo; how their families often suffer through broken ties and separations, the young man should consider well before determining to take up the profession, but when he does decide to do so, he should not let discouragement stop him.

To be successful in this life one should be a good reader of human nature and always on the lookout for the good in his fellowman, for he will never fail to find it. We all know the bad is there and are much more apt to call attention to it than we are to the good, but there is not a man living, though he may have sunk to the lowest round of the ladder who has not his good and noble traits. Put men on their honor and let them see that you trust them, and nine times out of ten your confidence will not be misplaced. I heard of a remarkable instance of this kind which took place in your city just after the great fire. A large firm had lost, along with its building, all of their books and accounts covering thousands of customers scattered over the country. The heads of the house held a meeting and finally decided to write to all the customers that the clerks and others could recall from memory, and lay the situation before them, *i. e.*, that they had not a scrap of paper by which they could hold any of them, but that they would leave it to their honor to settle with the house. The result was that almost every customer settled in full.

The world is a great looking-glass. Smile and it will smile back; say a good word about a man and he will say one about you. We are all dependent upon each other. You are as dependent upon your milkman as he is upon his banker. We must remember that every man has his side of the question, and to be just we must give it due consideration.

Everything is equalized in this world. You remember, the Bible says there were seven years of plenty followed by seven years of need. Every wave has its hollow. Every man his opportunity, and it is up to you to seize it as it passes.

If you want to make a success in this world start out right. Learn all you can at school, which is an opportunity that will not come again. It is the time during which you are gathering your tools together. And remember, that the crust of necessity is often a greater blessing to a boy leaving school than the golden spoon of prosperity.

A training school today is very different from what it was a few years ago. Then a man when he graduated was supposed to have a smattering of all the different branches. Now when you leave school you are supposed to have studied some special branch. Our life today is so strenuous that a man must know one thing well in order to keep up with the procession. Everything is developing specialists. We do not use the term "machinists" or "engineers", as that might not express the proper meaning, but the term "mechanic" covers the field well. It means a man who has had some special training and experience in the line of work under consideration, but what is more important, he must have a natural liking for the work to be done, and be able to grasp a situation quickly in an emergency.

Your days of school life are the days when you are walking through a valley under pleasant, clear skies and soft, south winds towards the mountain of life. From tonight you begin to climb the side of this mountain, and it will be but a short time when you will emerge upon the plateau of business life, swept by the cold, north winds, baked by the midday sun, with its rivers to cross and its many sloughs of despondency lying before you, where your true manhood will be tested to its utmost. This is the time when your school days and early home training will serve you well and uphold you. My mother's training has been one of the greatest helps of my life.

Don't be afraid to stand up for what you think is right, even though at the time it looks as if you were losing. What man in this busy world of life will not stop to take off his hat to a deed of kindness? It is only the kind, noble acts that live after you have played your little part upon the stage of this world and passed on. Some people say that the world is not growing better. I maintain that it is growing better every day; that people consider one another more than they ever have. Morals are better. Only look back to the times when one could not pass through the main streets of London or Paris without a strong guard. Be honest, not only in money matters, but with your fellowman. Don't talk behind his back—it always reacts. It does not raise you in the estimation of the man with whom you are talking. Don't make statements that you cannot verify, just for the sake of impressing people that you know it all. It only means that you will often have to swallow your own words, which is not pleasant. Be a man on whose word people can depend. They will soon find out the truth anyway. Character is the one thing that should shine out above all other traits. It is the foundation of manhood. It is the one thing that impresses people more than any other. It is said that no one ever meets another person, even though only for a moment, without leaving his impression on the other, either good or bad. The trials of life either harden or soften a man. Don't grow to be a hard man. Give and take. Be charitable in your treatment of others if you want them to be so with you.

The great key to success is perseverance, common sense, energy and last, but really first and most important of all, a firm trust in God. In starting out I made this my motto, and I can say to you tonight that it has been severely tested. There are times when only your trust in God will carry you through. It is the only thing that can be depended on in this world. So tonight, when you pack your kit preparatory to facing the trials of life, don't forget to take God into your confidence. This is the best asset a young man can have. It is worth more than all the gold you can possibly accumulate.

One of the things that makes you quicker to trust a man than anything else is the life he leads, and some day you will be surprised to know how much the men over you know about your daily life. Railroads and corporations are said not to have any souls. They will not invest their money in any enterprise until it is carefully considered and passed on by the various officials and they are as sure as they can be that it will bring in a return of dollars and cents. Therefore, when you see railroads and all kinds of corporations subscribing to such associations as the Young Men's Christian Association and other institutions that bring young men into an upright, wholesome, Christian atmosphere, you may know that it is because they have come to the conclusion, from a standpoint of dollars and cents, that the man who leads an upright life is more to be depended upon than one who has no regard for such things.

Remember, tonight, that you have the technical knowledge but not the experience. Do not expect to go out and command until you have first learned to obey. The better you obey and follow out your instructions, the better leader you will make later on. I do not mean that you should never express your views. Express them at the proper time just as freely and forcibly as you can, but if your superior does not accept them do not press your views further. You have done your part and his is the responsibility. Many a man has blighted his career by criticising his superior for not following his suggestions.

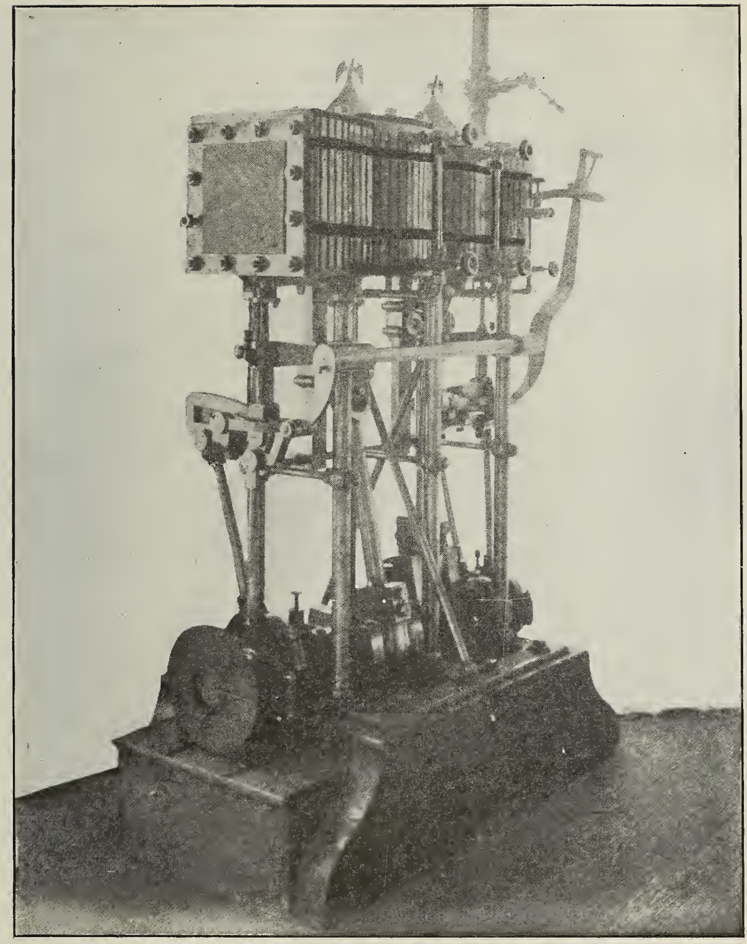
You can injure your employer's business and ruin your own opportunity by disloyalty. Loyalty does not mean that you must agree with your employer in every detail. Stand up for your own opinion before your employer, and for your employer's opinion before the world. Make this your creed and you will not go far astray. Be your own true self, but stand by the man that pays your salary, or quit.

Most men in charge like to have their men talk frankly and give expression to their views, but they soon learn to know which ones know how to take such treatment in the right light, and not become spoiled and their heads turned. Be prompt, both in getting to your office and in doing what has been told you. When you find you can trust a man and that he will give his undivided attention and loyalty to whatever duty you assign to him, you will soon begin to put more and more responsibility on him.

Don't be an extremist. Remember that the hero is not always the man who charges up a hill in company with thousands of others in the excitement of battle. He is more often the man who is plodding through life, doing his daily duty against the greatest odds, and never complaining. I call him the true hero. The great Napoleon, pining away on the rocky island of St. Helena in the midst of the Pacific ocean, remarked "I have conquered half the world by might and power; today I have not a single friend." Eighteen hundred years ago Jesus Christ, without money or the support of the people, began the conquest of the world by love and consideration to His fellow-man. Today, millions bow at the mention of His name.

And now young men before concluding my remarks I want to say one thing more to you. Don't forget when the time comes, which no doubt it soon will, when you are in charge of work and have men under you; when you have the say as to what shall be done about working on the Sabbath, that nothing is ever lost by observing that day. People will tell you that it is impossible to get along in the world without working on the Sabbath. There are cases where it is absolutely necessary, but they are few and far between to the man that makes up his mind that he wants to observe the Sabbath. I don't say this from mere hearsay, but from actual experience, both in railroad and municipal work.

I am afraid that my talk tonight has not been very flowery or interesting, but my whole desire has been to try and help you over the rough places by giving you the benefit of what little experience I have had.



COMPOUND ENGINE.

BUILT BY STUDENTS AFTER DESIGN OF THE BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT.

(Editorial in the BALTIMORE SUN, June 21st, 1906.)

ADVICE GOOD FOR ALL.

The advice given by Chief Engineer Hendrick, of the Sewerage Commission, to the graduates of the Baltimore Polytechnic Institute, Tuesday, and reported in THE SUN, contains so much good sense and inspiration to any young man beginning his business career it is worth many readings and much careful pondering. The principles laid down are of wide application and of practical value. Engineering is shown to be a most exacting profession, requiring industry, resolution, perseverance under all discouragements, a keen sense of honor, kindliness and "trust in God." Loyalty to one's employer is urged upon the young engineer—advice good in every line of business. "Be your true self," said the speaker, "and stand by the man that pays your salary, or quit." Men are better than you may be led to suppose, and the world is getting better. Trust begets trust, kind words are repaid in kind. Common sense, energy and perseverance are the keys to success, but "there are times when only your trust in God will carry you through." Such are the leading sentiments of the address, which indicates that Baltimore in getting a first-rate engineer for an important public work got also a very competent advisor for its rising generation.

MARYLAND'S INFLUENCE IN FOUNDING A NATIONAL COMMONWEALTH.

Address in Commemoration of Maryland Day (March 25th),
Delivered March 23rd, 1906, at the Baltimore
Polytechnic Institute,

BY

Clayton C. Hall, LL. B., A. M.

On Sunday next will occur the 272d anniversary of the landing of the colonists of Maryland under the charter promised by Charles I, King of England, to the first Lord Baltimore, but granted, on account of the latter's death, to his son Cecilius, the second Lord Baltimore.

At that time the new year began with March 25th, so that the landing at St. Clement's Island in the Potomac, at the mouth of St. Mary's River, was not only made upon a high feast day of the church, but also upon New Year's day, 1634.

Last year we were asked by the Superintendent of Public Education that in the celebration of this anniversary special reference should be made to the establishment of religious liberty in the province of Maryland, in an age and at a time when religious intolerance prevailed, not only in the old world but in the American Colonies to the north and to the south of us. This bright fact in Maryland's history, that here, first in all the world, and at the very founding of the colony, the principle of religious liberty was established as a practical rule in the administration of justice, was then duly commemorated.

This year the subject to which we are asked to give special attention is "Maryland's Influence in Founding a National Commonwealth." The important part, in fact the controlling influence, exercised in this matter by this State, small as it is geographically, has generally been overlooked or deliberately ignored. For this Marylanders have been in part to blame, for they left the task of writing school histories to others, and when there occurred in them what is called in law "such suppression of facts as is equivalent to wilful misrepresentation" they sat idly by and made no protest. The consequence has been that even those who have been educated in our own schools have read so much of the so called "Tea Party" in Bosten, but know little of the burning of the brig "Peggy Stewart" with her cargo of tea at Annapolis. They have read of Lexington and Bunker Hill, of the battle of Long Island, and the surrender of Cornwallis at Yorktown, but they were not always told that at the beginning of the Revolutionary War among the first troops to arrive at the camp of the Continental Army at Cambridge, Massachusett, were the Frederick Riflemen who had actually marched from Maryland. That at Long Island the American Army was saved from destruction by the Maryland battalion at the sacrifice of more than half its number; and that the Maryland troops alone succeeded in learning under the training of Baron Steuben, who in the Seven Years' War had served on the staff of Frederick the Great, to break the ranks of the British veterans at the point of the bayonet, a feat which they accomplished repeatedly, are details which are not always thought worthy of mention.

The fact that it was solely through the persistence, and the insistence, of Marylands's statesmen, that such action was taken in respect to the great northwest as resulted in the creation of a national domain and made possible the development of the Federal Union as one of the great nations of the world, has been generally ignored.

Let us consider briefly the situation toward each other of the American Colonies at the time of the Revolution. Some of the Colonies were limited to certain defined areas included within prescribed boundaries. Among these were Rhode Island, New Jersey, Delaware and Maryland. By the terms of the charter granted by Charles I to Lord Baltimore the western boundary of Maryland was fixed at the meridian of the first fountain of the Potomac River.

Other Colonies, notably Massachusetts, Connecticut, New York and Virginia, held charters which in more or less ambiguous language, framed in total and contented ignorance on the part of the royal grantors and their advisors as to the extent of the American Continent, extended their boundaries westward to the great waters (the Mississippi) or "from sea to sea."

At the time of the Revolution the Colonies first associated themselves for the purpose of fighting side by side for independence. But soon it was recognized that something more definite was needed, and therefore Articles of Confederation were proposed and submitted for adoption to the several States (for so the Colonies now called themselves).

Under the terms of the charters just referred to, assuming that the "parts of America" were crown lands of the King of England (despite the claims of France and Spain), the whole of the vast western territory pertained to a few of the thirteen States, the largest and most formidable claims being those of Virginia and New York.

The States of which the area was fixed and limited protested with more or less vigor against this assignment of the western land as pertaining to particular States, but with the exception of Maryland they protested not on the ground of principle, but simply on the selfish plea that they wished a partition. They merely wanted to share in the value of the booty, either in land or money.

Maryland alone, with far-seeing statesmanship, recognized and maintained the principle that this great territory instead of being conceded to the few States that claimed exclusive title thereto, or even parcelled out among the thirteen States in severalty, should be created into a public domain to be held by the nation about to be formed for the benefit of the whole, and not of the separate parts; a territory in which future States could be erected, to be admitted into union with the original thirteen.

On October 15th, 1777, exactly one month before the Articles of Confederation were proposed to the several legislative bodies, Maryland moved in the Continental Congress "that the United States in Congress assembled shall have the sole and exclusive right and power to ascertain and fix the western boundary of such States as claim to the Mississippi or South Sea (by which the Pacific Ocean was meant), and lay out the land beyond the boundary so ascertained in separate and independent States, from time to time, as the numbers and circumstances of the people may require."

In these words the entire policy for the subsequent growth of the nation is expressed. And yet, when the question was put, Maryland alone voted in the affirmative. But the proposal contained, as was pointed out by the late Herbert B. Adams, Professor of History at the Johns Hopkins University, what the Germans call a *bahnbrechende Idee* — a "road-breaking idea." It presented the conception of a future national existence and pointed out the way to the goal.

This bold proposition naturally provoked the opposition and even the hostility of the States which claimed the western lands. Such animosity was excited that it was even suggested to dispose of Maryland by partition, like a new-world Poland, among the neighboring States. But the field of battle was not the only field in which the men of Maryland could hold their own.

By February 1779 all the other States had ratified the Articles of Confederation. Maryland was thus left alone, but she still held out until the question of the western territory should be settled. What was the result?

In May, 1779, "Instructions" from the Maryland Assembly to her delegates in Congress were read before that body. The document is too long to read today in full, but it is one of the most notable and momentuous state documents ever written in this land. The whole subject was ably argued. In these instructions it was again urged that this western territory "if wrested from the common enemy by the blood and treasure of the thirteen States should be considered as a common property, subject to be parcelled out by Congress into free, convenient, and independent governments." The delegates were instructed "not to agree to the confederation unless an article or articles be added thereto in conformity with our declaration. Should we succeed in obtaining such article or articles then you are hereby fully empowered to accede to the confederation." It was said in conclusion,—"we have spoken with freedom as becomes freemen, and we sincerely wish that these our representations may make such an impression in that Assembly as to induce them to make such addition to the Articles of Confederation as may bring about a permanent union."

In September, 1780, a report upon the subject was made by a committee of Congress, and the inflence of Maryland's contention is shown in this report. It was said: "It appears more advisable to press upon these States which can remove the embarrassment respecting the western country a liberal surrender of a portion of their territorial claims, since they cannot be preserved entire without endangering the stability of the general Confederacy." And the respective legislatures were urged to undertake "a full and impartial consideration of a subject so interesting to the United States, and so necessary to the happy establishment of the federal union."

Finally, in January, 1781, Virginia ceded to the Congress all of her claim to the western territory, specially stipulating for the formation therein of distinct republican States (which was precisely what Maryland had demanded); but certain conditions were annexed in respect to the settled region south of the Ohio River, now the State of Kentucky, and some other matters which need not now be noticed. Acceptable terms were also obtained from Massachusetts and Connecticut, each of which claimed narrow strips of territory west of New York; and on March 1, 1781, an offer from New York, which had been previously authorized by the Legislature of that State, to make either an unreserved or a limited cession of her western lands, was presented in Congress. The object of their long fight being thus accomplished, and victory won, the delegates from Maryland, faithful to their promise, immediately, in fact on the very same day, in accordance with the authority already given to them, gave Maryland's ratification to the Articles of Confederation.

It will be observed that the War of the Revolution was nearly ended. In less than eight months after Maryland's accession to the Confederation, Cornwallis surrendered at Yorktown. Therefore throughout nearly the whole of that war, in which no troops did braver or more gallant service than those of the Maryland Line, Maryland was in fact an ally, and not a member of the Confederacy. No battle of the Revolution was fought on Maryland soil, and therefore the men of Maryland fought, not directly for home and fireside, but for principle. And yet in every battle from Long Island to Savannah, the Maryland Line was present, and more than once, by impetuous valor, turned defeat into victory.

Simultaneous with warfare against the forces of Great Britain on the field of battle, her representatives were maintaining a single-handed contest with the Confederated Colonies for the assertion and establishment of a constitutional principle which has had more to do perhaps than any other one thing in shaping the destiny of the nation.

Attention has recently been called to the fact that the flag of John Paul Jones, the first representation of the star-spangled banner that was ever flung to the breeze, contained but twelve stars. Maryland had not yet been enrolled in the galaxy of States.

The Articles of Confederation were at best but a loose compact. They contained no provision for regulating Commerce between the States or duties upon imports, and Congress was powerless to enforce its own acts or the decisions of the Federal Courts. These things called for "a more perfect union"; while the possession of a national domain, procured through Maryland's brave action, necessitated a somewhat centralized power to exercise authority where no one State had jurisdiction, and to provide for the erection of new States and their admission to the Union.

From Annapolis, the Capitol of Maryland, went out the call for a convention to be held in Philadelphia for the purpose of framing the Constitution of the United States, the Constitution under which our national government exists today.

It is unquestionably true that in taking the position which we have just been considering, Maryland stamped the character of our national organization. And the results have been far reaching in national growth and development. As an illustration may be cited the Louisiana purchase of which the centennial anniversary was celebrated at St. Louis a year ago. By that purchase an enormous territory *west* of the Mississippi was acquired from France and added to the national domain. If the ancient claims of those States whose borders were thought to run from sea to sea, that is from the Atlantic to the Pacific, had not previously been surrendered through Maryland's insistence, that purchase would have been impossible, for the territory acquired would then have ennured to the several States so claiming, instead of to the nation as a whole.

Again when the federal constitution was finally framed and proposed to the States, there was much doubt as to its adoption. Six States, one short of a majority, ratified it, Massachusetts being the sixth; then there was a halt. The influential States—South Carolina, Virginia and New York—were deemed hostile. If either of these States had acted next and adversely the Constitution would in all probability have been defeated. In this juncture Maryland's vote was hastened not only upon the advice of some of her own statesman, as against others of them that were opposed,—(Luther Martin, of this State, who has been described as the greatest lawyer America ever produced, was opposed)—but also at the urgent appeal of those two great Virginians, Washington and Madison; and Maryland's vote was given, the seventh in order of ratification, making a majority of the thirteen. This action was decisive, and thus, for a second time, Maryland determined the fate of the nation. The remaining States followed in line. South Carolina voted eighth, Virginia tenth and New York eleventh.

There is one other subject that may be mentioned, which is interesting, though a matter of conjecture only. You do not need to be reminded that it was Maryland that made out of its narrow territory a gift to the Nation of the District of Columbia as a site for the Nation's Capital.

If in 1861 Maryland had seceded, that Capital would have been included in the area of the Confederate States, and as a consequence thereof the result of the Civil War might perhaps have been other than it was. Maryland did not secede, though possibly she would have done so but that before action was taken, in fact on the eve of a meeting of the State Legislature, the most influential leaders in that body were arrested by the Federal authorities and cast into a military prison. This subject is apart from the one specially proposed for us today, which is Maryland's part in *founding* the Republic, but is it not possible that for a third time, at the critical period of the Civil War, the fate of the nation hinged upon and was decided by the position of Maryland, even though, in this instance, its position may have been determined by what lawyers call *Vis major?*

SOME RECENT EXAMINATION PAPERS.

STEAM ENGINEERING.

FOURTH YEAR CLASS—MAY 28, 1906.

1. Find the indicated steam consumption of the engine from which the given indicator diagram was taken.

2. Given: travel of valve, 5″; lead, ⅛″; cut-off, 65% of stroke; compression 15% of stroke from end. Find: angle of advance, release, steam lap, and exhaust lap. Scale, full size.

3. What two methods are used for starting and stopping a boiler test? Describe each. How is the coal sampled, and the amount of moisture and of ash determined?

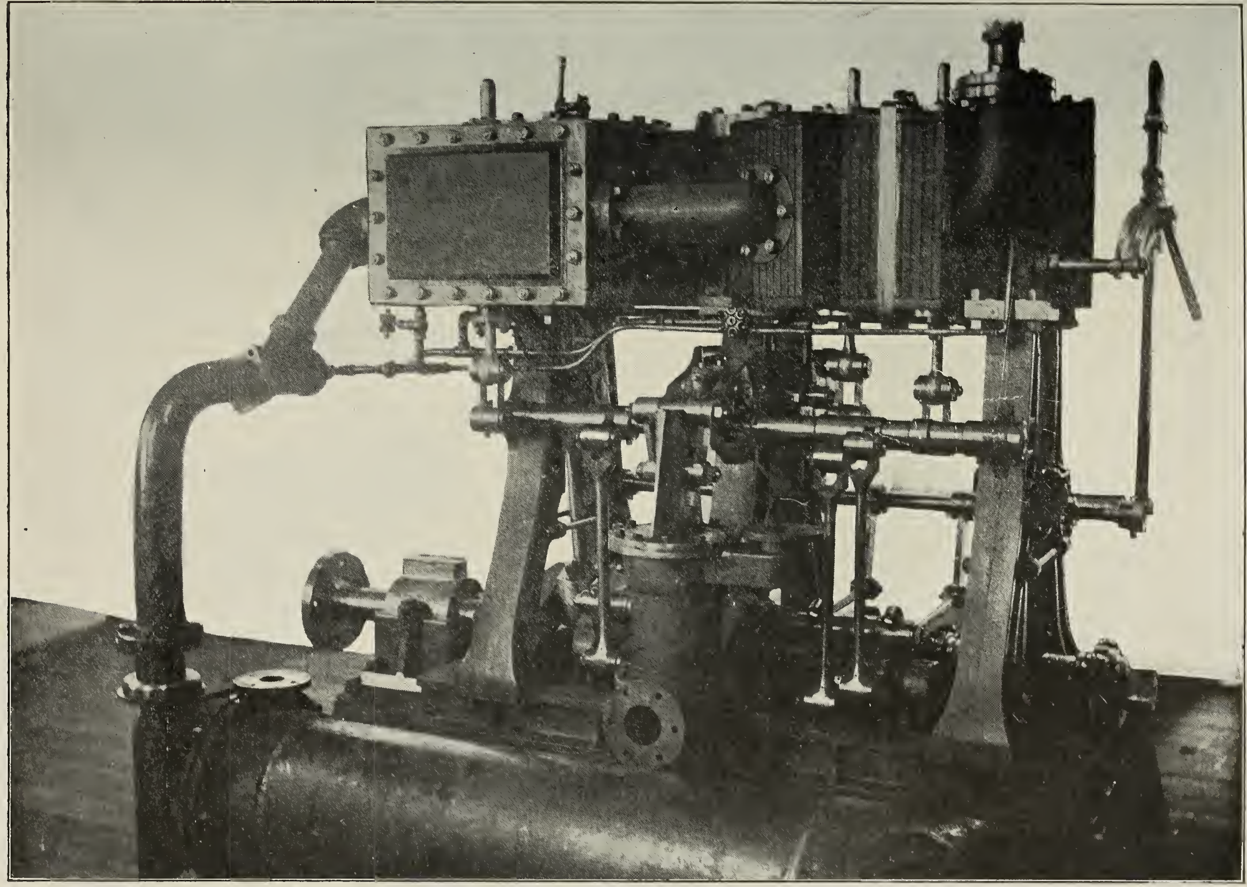
4. The result of an engine test shows 18 lbs. of steam per I. H. P. per hour. The steam is superheated 50° and has a pressure of 100 lbs. per gauge and temperature of 337.5°. There is a vacuum in the condenser of 26 inches, corresponding to a temperature of 126°. Find the thermal efficiency of the engine.

5. In a boiler test the gauge indicated 100 lbs.; the temperature and pressure in a throttling calorimeter of the Peabody type was 345° and 2 lbs. per gauge, respectively. Was the steam moist or superheated, and how much so?

6. Show that the weight of the reciprocating parts of a simple duplex engine is greater than those of a compound engine of the same power, the two types having in common: initial steam pressure, 115 lbs. absolute; exhaust pressure 2 lbs. absolute; ratio of expansion 8. For the compound engine the receiver pressure is 28 lbs. absolute and the ratio of cylinders is 4.

7. (For first section only.) Trace, with the aid of a sketch, the sequence of forces on the engine mechanism, starting with a variable steam pressure on the piston and ending with the constant external resistance at the belt pulley.

8. (For second section only.) Find the size of cylinders for a compound engine to develop 70 I. H. P., the initial steam pressure being 135 lbs. absolute and the vacuum 26 inches. Assume: total ratio of expansion, 6; cylinder ratio, 3.13; piston speed 450 per minute; mean pressure factor, 0.8.



TRIPLE EXPANSION ENGINE.

BUILT BY STUDENTS AFTER DESIGN OF THE BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT.

MATERIALS OF ENGINEERING.

FOURTH YEAR CLASS—FEBRUARY 3, 1904.

1. What metals are used in forming alloys suitable for engineering purposes? What names are given the resulting compositions?

2. In the classification of iron and steel what metals are known as malleable, semi-malleable, and non-malleable?

3. How is the quality of cast-iron effected by the different methods and fuels employed in its reduction? From what source does cast-iron absorb much carbon? What is the difference in character of cast-iron containing a high percentage of graphitic carbon and that containing a high percentage of combined carbon? What brand of pig-iron is much used in castings requiring the maximum of strength?

4. How can cast-iron be made partly malleable? Sketch and give dimensions of specimens of cast-iron for compression, transverse, and tensile tests. Give, as a result of your experience in testing, the average crushing, transverse, and tensile strengths of cast-iron in pounds per square inch.

5. By what process is the most of wrought-iron produced? What element is nearly eliminated from the iron by this process? State some of the properties of wrought-iron. When testing wrought-iron, what have you found to be the tensile strength per square inch, and the percentage of elongation in 8 inches?

6. By what process is wrought-iron converted into the high-grade steel known as tool steel? What is the process for converting cast-iron into mild, or structural steel? Which of the two methods for converting cast-iron into structural steel is preferable when the material is to be used in the construction of boilers and shafting? Explain what is meant: (*a*) by the basic process; (*b*) by the acid process.

7. What impurities, other than carbon, are contained in steel? How are the strength and ductility of steel affected by the amount of carbon it contains? What is semi-steel?

8. Describe the different physical tests for structural steel? Make a sketch showing the forms and dimensions of specimens used for testing steel for boiler plates and for steel forgings. Given a forged steel specimen finished to ¾″ diameter and 2″ between centre dots; how would you proceed with the test?

SEMI-ANNUAL EXAMINATION IN MECHANICS.

FOURTH YEAR CLASS, JANUARY 30, 1905.

1. A rod 11″ long has a weight of 7 ounces at one end, and a weight of 8 ounces at the other end, and is found to be in equilibrium when balancing on a fulcrum 5″ from the heavier weight. If the weights are interchanged the fulcrum must be shifted 11/17 of an inch. Find the weight of the rod, and the position of its centre of gravity.

2. Two scale pans are suspended from the two ends of a straight lever whose arms are as 3 to 4, and an iron bar of 20 pounds weight is laid on the scale pans, and will just reach from the one to the other; find what weight must be placed into one scale to preserve equilibrium.

3. Two equal weights are attached to the ends of a string which is laid over the top of two equally rough planes, having the same altitude and placed back to back, the angles of inclination of the planes to the horizon being 30° and 60°, respectively. The weights being just on the point of moving, find the coefficient of friction.

4. A beam capable of moving about one end is kept in a position inclined to the horizon at an angle of 60° by a string attached to the other end; the string is inclined to the horizon at an angle of 60° in an opposite direction: compare the tension of the string with the weight of the beam.

5. The foot of a derrick pole of 240 pounds weight rests on the ground, and a weight of 2 tons is suspended from the other end of the pole. The length of the pole is 22 feet, and it is kept in position by a guy rope 28 feet long, fastened to the ground 12 feet to the rear of the foot of the pole. Find, graphically or otherwise, the tension of the guy and the thrust of the boom. Scales for graphic solution:—$\frac{1}{8}$ inch = 1 ft., and 1/16 inch = 100 lbs.

6. A body starting from a given point, moves vertically downwards at the rate of 32.2 feet per second. After 4 seconds a heavy body falls from the same point under the action of gravity. Show that it will overtake the first body at a distance of 257.6 feet from the starting point.

7. A stream of water passes over a dam and falls through a vertical height of 16 feet, the transverse section of the stream at the foot of the fall being one square foot; find the H. P. that is constantly developed, taking the weight of a cubic foot of water as 62.5 pounds.

8. A flat plate, ABCDE, is right-angled at A, the sides AB and AE being 12″ and 9″, respectively. The corner C is distant 14″ from B and 9″ from E. The side ED is 8″ long, and the point D lies in the prolongation of the line joining B and E. Locate graphically the c. of g. of the

plate, and give its distance from the corner A. Scale of lengths, $\frac{1}{4}$; scale of areas, 1/16 inch = 1 square inch.

9. Determine the H. P. that may be transmitted by a belt 6 inches wide and $\frac{1}{4}$ inch thick, running at a speed of 60 feet per second, the tension in the slack side of the belt being 0.45 of that in the tight side, and the stress allowed being 280 lbs. per sq. inch of section. To what extent will the effect of centrifugal action reduce this power?

10. The wheelwork of a crane consists of a pinion of 12 teeth, driven by a lever handle 18″ long, gearing with a wheel of 92 teeth, and of a pinion of 14 teeth gearing with a wheel of 72 teeth on the drum axle. The diameter of the drum is 18″, the power applied to the handle 60 lbs., the pitch of the teeth 1.25″, and the handle makes 20 revs. per min. Find the weight lifted, the tangential pressures between the teeth of the wheels in contact, and the H. P. transmitted through the train.

MECHANICS OF MATERIALS.

FOURTH YEAR CLASS—MAY 18, 1906.

1. How much stronger is a beam 6 inches wide, 12 inches deep, and 8 feet long, than one 4 inches wide, 10 inches deep, and $11\frac{1}{16}$ inches long.

2. A beam 20 feet long, rests on supports 12 feet apart. The left support is 3 feet from the end. The beam is loaded thus: 2 tons at the extreme left end, 2 tons at 1.5 feet from it, 3 tons at 5 feet from it, 8 tons at 12 feet from it, and 6 tons at the extreme right end. Write the value of the bending moment under each load and at the supports.

3. A beam arranged with symmetrical overhanging ends is loaded with three equal loads—one at each end and one at the middle. The bending moments over the supports and at the middle being equal, it is required to find at what section the bending moment is zero, and also the distance apart of the supports in terms of the total length L.

4. Find the diameter of a hollow steel shaft to transmit 5000 H. P. at 175 revolutions per minute, the outermost fibre stress being 10,000 lbs. per square inch, the external diameter twice the inner, and the maximum twisting moment 1.5 times the mean.

5. Find the safe load on a hollow round cast-iron column with fixed ends, when the external diameter is 12 inches, thickness 1.25 inches, length 14 feet, and factor of safety 8.

6. What is the safe uniformly distributed load of a 6 inch I beam resting on end supports 20 feet apart, if the deflection is limited to $\frac{1}{360}$ of the span. E = 30,000,000; weight of beam 14.75 lbs. per foot.

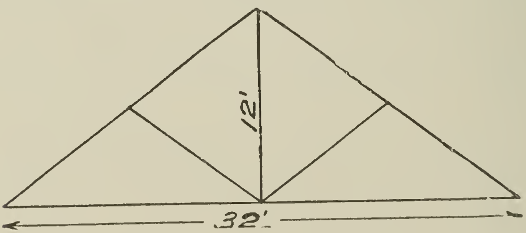
GRAPHIC STATICS.

FOURTH YEAR CLASS—MAY 24, 1906.

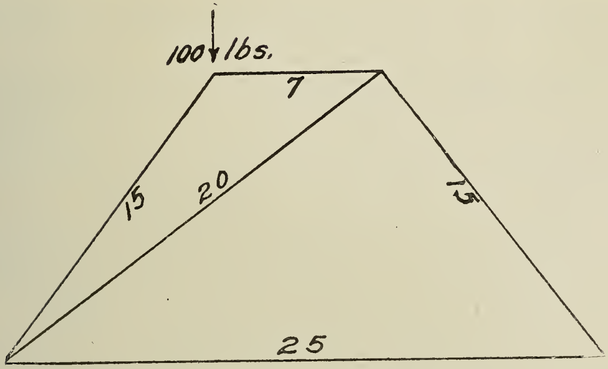
1. A cantilever 14 feet long, supports three concentrated loads—500 lbs. at 4 feet from the support, 600 lbs. at ten from the support, and 200 lbs. at the extremity. In addition, it bears a uniformly distributed load of 80 lbs. per foot. Construct the bending-moment and shear diagrams. Polar distance, 1.25 inches; linear scale, 1 inch = 6 feet; load scale, 1 inch = 1000 lbs.

2. A beam, overhanging its supports equally, carries a uniformly distributed load of 80 lbs. per foot, and has a load of 1000 lbs. concentrated at its middle; the length of the beam is 15 feet and the distance between the supports is 8 feet. Construct the bending-moment and shear diagrams, and prove the accuracy of your construction by obtaining by calculation the distance of the points of inflection from the supports. Polard istance, 1 inch; linear scale, 1 inch = 5 feet; load scale, 1 inch = 1000 lbs.

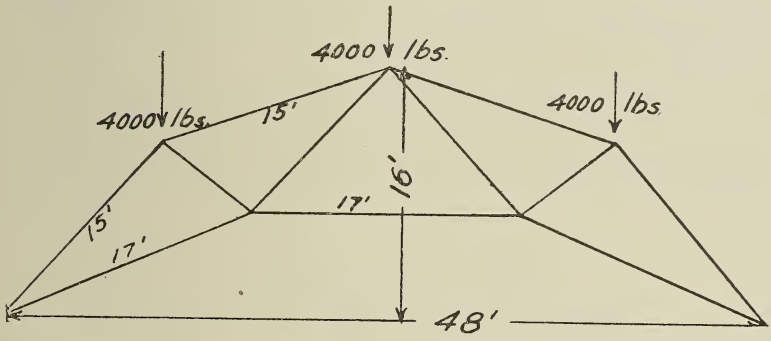
3. The roof truss of the figure, having a span of 32 feet and height of 12 feet, is loaded uniformly on the right-hand side with 8 tons and with 6 tons on the left-hand side. Find, by a Ritter section, the stress in the upper half of the right-hand rafter.



4. The light trapezoidal frame of the figure, having one diagonal brace, is supported at the extremities of the lower chord and bears a weight of 100 lbs. at the upper left-hand corner. Find the pressure on the supports and the stresses in the members of the frame. Linear scale, 1 inch = 6 feet; load scale, 1 inch = 50 lbs.



5. The roof truss of the figure is loaded as shown. Find and tabulate the stresses in its members. Check for accuracy by finding the stress in the horizontal member by the section method. Linear scale, 1 inch=10 feet; load scale, 1 inch=4000 lbs.



STEAM ENGINEERING.

THIRD YEAR CLASS—MAY 25, 1906.

1. Derive the formula showing the relation between degrees of temperature on the three scales: Fahrenheit, Centigrade, and Reaumur. How many degrees Centigrade is equivalent to 350° Fahrenheit?

2. If the pressure of saturated steam in pounds per square inch absolute is given, explain how to find the following quantities: temper-

ature, sensible heat, total heat, latent heat, external heat, internal work, and specific volume. Where formulas are used, explain what the symbols mean.

3. Coal contains 85% C, 5% H, 6% O, the remainder being ash. The temperature of the air is 65° and 20 lbs. of it are used per pound of coal. The temperature of the chimney gases is 615°. The specific heats of nitrogen, carbon dioxide, superheated steam, and oxygen are 0.244, 0.217, 0.475, and 0.218 respectively. Find the temperatare of the furnace and the heat in the chimney gases per pound of coal.

4. Steam has a pressure of 100 lbs. per gauge, the corresponding temperature being 337.5°. Find the heat necessary to generate one pound of steam for the conditions: (*a*) dry and saturated; (*b*) 1.5% moisture; (*c*) 50° superheat. Feed water temperature, 126°.

5. During a boiler test lasting 48 hours, 144,000 lbs. of feed water are measured and 18,000 lbs. of coal are burned. The steam contains 1.5% of moisture, the pressure being 100 lbs. per gauge. The thermal value of the fuel is 15,000 B. T. U. and the temperature of the feed water 126°. Find the boiler efficiency and the boiler horse power.

6. The result of an engine test gives 18 pounds of steam per I. H. P. per hour. The steam is of 100 lbs. pressure per gauge and is superheated to the extent of 50°. There is a vacuum in the condenser of 26 inches, corresponding to a temperature of 126°. Find the thermal efficiency of the engine.

7. Find the distance of the piston from each end of the stroke in a 9″ x 10″ engine, the crank-connecting-rod ratio being ⅙, and the crank making an angle of 120° with the head dead centre. What is the amount of the irregularity caused by the angularity of the connecting rod in this case?

PLANE TRIGONOMETRY.

THIRD YEAR CLASS—FEBRUARY 2, 1906.

1. Solve $\sin x + \sqrt{3}\cos x = 2$.

2. From the top of a lighthouse, 109.67 feet high, the angle of depression of a boat was found to be 24° 2′ 20″. Find the distance of the boat from the base of the lighthouse.

3. Find the perimeter of a regular dodecagon circumscribed about a circle the circumference of which is one foot.

4. Tabulate the values of the sine, cosine, tangent and cotangent of 0°, 30°, 45°, 60°, 90°, 120°, 135°, 150°, and 180°.

5. Derive the formulas for the functions of double an angle.

6. Prove that $\dfrac{\sin 46^\circ + \sin 4^\circ}{\cos 46^\circ + \cos 4^\circ} = \tan 25^\circ$.

7. Find the value of $\sin(\tan^{-1}\frac{5}{12})$.

8. The base line connecting two observatories, A and B, is 600 feet. Find the distance of a point, C, from each if the angles CAB and CBA are respectively 30°, 25′ 20″ and 119° 34′ 40″.

9. Derive the formula for $\sin\frac{1}{2}A$ in terms of the three sides of a triangle.

10. If a chandelier weighing 90 lbs., supported by two rafters, produces a pressure of 51.96 lbs. along each, what is the angle between the rafters?

ANALYTIC GEOMETRY.

THIRD YEAR CLASS—JUNE 1, 1906.

1. Find the length of that part of the straight line, $3x - 4y = 0$, which is contained within the circle $x^2 + y^2 = 25$.

2. A point, F, is situated at a distance of 6 inches from the line BC. A moving point, P, is always equidistant from F and BC. Find the equation of the locus of P.

3. Find the vertices and the area of the triangle whose sides are $2x + 9y + 17 = 0$, $y = 7x - 38$, and $2y - x = 2$.

4. Find the angle formed by the lines $y = mx + b$ and $y = m'x + d$.

5. Find three forms of the equation of the circle referred to rectangular axes.

6. Prove that the latùs rectum of a parabola is a third proportional to any abscissa and its corresponding ordinate.

7. Prove that the tangents drawn through the ends of the latus rectum of a parabola are perpendicular to each other.

8. Find the equation of the tangent to the hyperbola, $b^2x^2 - a^2y^2 = a^2b^2$, in terms of the coördinates of the point of contact.

9. Find the equation of the director circle of $b^2x^2 - a^2y^2 = a^2b^2$.

10. Describe the conchoid of Nicomedes and find its equation.

DIFFERENTIAL CALCULUS.

FOURTH YEAR CLASS—FEBRUARY 7, 1906.

1. If $\frac{a}{x}$ approaches 0 as a limit and $\frac{\beta}{y}$ approaches 0 as a limit, prove limit $\frac{x + a}{y + \beta}$ = limit $\frac{x}{y}$.

2. Derive the formula for the differentiation of the product of two variables.

3. If $y = e^{-x} \cos x$ prove $\frac{d^4y}{dx^4} + 4y = 0$.

4. Derive the formula for the radius of curvature.

5. Compute the angle at which the following curves intersect:

$$y = 3x^2 - 1 \text{ and } y = 2x^2 + 3.$$

6. Find $\frac{dy}{dx}$ if $y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$; if $y = \log(\log x)$.

7. What should be the ratio between the diameter of the base and the height of a tin cup in order that the amount of tin used in constructing it may be the least.

8. In the cissoid $y^2 = \frac{x^3}{2a - x}$ show that the subtangent is equal to $\frac{2ax - x^2}{3a - x}$

INTEGRAL CALCULUS.

FOURTH YEAR CLASS — MAY 31, 1906.

1. Derive the formulas: (a) $\int \tan u \, du$; (b) $\int \frac{du}{u^2 - a^2}$

2. $\int x^2 \cos x \, dx$.

3. (a) $\int (a \tan x \sec x + b) \cot x \, dx$; (b) $\int \frac{\sec x \tan x}{\tan^2 x - 2} dx$.

4. Find the area intercepted between the coördinate axes and the parabola $x^{\frac{1}{2}} + y^{\frac{1}{2}} = a^{\frac{1}{2}}$.

5. Find the volume of the prolate spheroid generated by the revolution of the ellipse $b^2x^2 + a^2y^2 = a^2b^2$ about the x axis.

6. Show that the volume generated by one semi-undulation of the curve $y = b \sin \frac{x}{a}$ is equal to one-half that of the circumscribing cylinder.

7. $\int \frac{x^3 - 1}{x^3 + 3x} dx$.

8. (a) $\int \sin^7 x \, dx$; (b) $\int \cos^4 x \, dx$.

9. $\int \tan^7 x \sec^3 x \, dx.$

10. $\int_a^b \int_c^d \int_e^f r^4(dr)^3$

11. Find the area of a sector of the spiral of Archimedes $p = a\theta$, between $\theta = a$ and $\theta = \beta$.

12. Find the moment of inertia of the triangle formed by the axes and a line whose intercepts are a and b, about an axis which passes through the origin and is perpendicular to the plane of the triangle.

SPHERICAL TRIGONOMETRY AND SURVEYING.

THIRD YEAR—MAY 27, 1904.

1. In a right spherical triangle prove $\tan^2 \frac{B}{2} = \frac{\sin (c-a)}{\sin (c+a)}$.

2. Find b, A and B in a right spherical triangle when c=55° 9′ 32″ and a=22° 15′ 7″.

3. In an oblique spherical triangle prove

$$\cos a = \cos b \cos c + \sin b \sin c \cos A.$$

4. Given b=63° 15′ 12″, c=47° 42′ 1″, A=59° 4′ 25″; determine B, C and a.

5. Explain fully how to measure across a body of water, using only a chain.

6. Make a sketch of a portion of a leveling rod, showing the position of the vernier when the reading is 4.873 feet.

7. Reading angles, making use of the vernier.

8, 9, 10. Compute the area and make a plot from the following notes:

STATIONS.	BEARINGS.	DISTANCES.
1	S. 20° 45′ E.	13.11 chains.
2	N. 48° 15′ E.	13.62 chains.
3	N. 43° 45′ W.	4.73 chains.
4	N. 45° 15′ W.	4.75 chains.
5	S. 51° 30′ W.	2.53 chains.
6	S. 72° 30′ W.	6.56 chains.

CHEMISTRY.

FOURTH YEAR CLASS—FEBRUARY 2, 1906.

1. Give the occurrence in nature, method of preparation, physical and chemical properties, symbol, atomic weight, and valence of either oxygen or hydrogen.

2. Explain fully the following: Combustion, oxidation, kindling temperature, and reduction.

3. Give the laws of definite proportions and of multiple proportions.

4. Give the occurrence in nature, method of preparation, and general properties of chlorine. Name its compound with hydrogen and with oxygen and hydrogen, giving formulae.

5. Give the occurrence in nature, symbol, and atomic weight of carbon. Describe some of the simple compounds of carbon.

6. What corrections must be made when making calculations for the synthesis of water?

7. Give the constituents of atmospheric air, with parts by weight and by volume.

8. It is desired to make a litre of each of two solutions, potassium hydroxide and hydrochloric acid, of such strengths that 1 c. c. of one will neutralize 1 c. c. of the other. How much KHO and HCl (40 per cent.) are necessary, if the potassium hydroxide solution contains 39 grams of potassium?

ANALYTICAL CHEMISTRY.

FOURTH YEAR CLASS—FEBRUARY 2, 1906.

1. Give tests for following substances: Copper, silver, arsenic, barium.

2. Give the flame colors of the following: Sodium, potassium, copper, strontium, boric acid.

3. What substances must be removed before testing for potassium? How is this accomplished? What is the test for potassium?

4. Why must members of group I of the bases be removed before making the test for group II, division B, of the acids?

5. Outline the analysis of a powder insoluble in water or acid.

6. How is division B, group II of the bases, separated from the other members of the same group? What substances are involved in this separation?

7. How is a ferrous compound distinguished from a ferric? Give equation for changing a ferrous to a ferric compound by addition of nitric acid.

8. Give equation for the reactions when ammonium carbonate is added to salts of barium, strontium, and calcium. Also show the reactions when the resulting compounds are dissolved in acetic acid.

ELECTRICITY.

FOURTH YEAR CLASS—JANUARY 26, 1906.

1. How are the relative dimensions of a dynamo armature determined? Illustrate, using four poles.

2. If the flux per pole is 3,200,000 lines, how would the sectional dimensions of the yoke of a dynamo be calculated, the density in the yoke and magnet-limbs being limited to 110,000 lines per square inch?

3. Give scheme and diagram for a two-circuit winding for a four pole dynamo, the pitch of the winding being 7.

4. Describe the action of a dynamo when the following troubles exist: Short circuit in one armature coil; open circuit in one armature coil; magnetism in fields reversed; residual magnetism lost.

5. Outline the design of a series wound motor to deliver 20 H. P. at 900 R. P. M., the efficiency of conversion and the electrical efficiency each being 90 per cent. The motor is to be operated on 220 volts and has a field loss of 3 per cent.

6. What losses occur in dynamos and motors? Briefly state the methods for calculating them.

7. Construct the diagram for the action of a transformer, showing the relative values of current and electromotive force in primary and secondary coils, designating the various lines by the usual letters and numbering them in the order in which they are drawn.

8. Outline the design of a transformer.

ANALYTIC CHEMISTRY.

FOURTH YEAR CLASS—MAY 22, 1906.

1. What weight of KCl per liter must be used to make a solution that will precipitate .02 gram of silver per cubic centimeter? K 39, Cl 35.4, Ag 108.

2. A test for ammonia is made and the following data recorded: Solution used, 25 c. c.; normal sulphuric acid, 100 c. c.; normal potash solution titrated, 40 c. c. What per cent. of ammonia is indicated?

3. Outline a gravimetric analysis of a barium salt.

4. How much dry ferrous sulphate should be dissolved in one liter of water to make a solution containing 3 per cent. of iron? Fe 56.

5. Describe the combustion method for the determination of carbon in steel.

6. Calculate the weight of iron or steel to be used in a test for phosphorus, so that the weight of precipitate, $(NH^4)^3(MoO_3)_{11}PO_4+9H_2O$, in grams, will be the same as the per cent. of phosphorus. Mo 96, P 31.

7. Describe the colorimeter test for per cent. of manganese.

8. In a sulphur determination, 80 c. c. of an iodine solution, containing 3.97 grams of iodine to the liter, were required to titrate the sulphuretted hydrogen from 10 grams of iron. What per cent. of sulphur is indicated?

GENERAL CHEMISTRY.

FOURTH YEAR CLASS—MAY 22, 1906.

1. Describe the elements of the chlorine group, giving a general method of obtaining them from their compounds.

2. Outline the methods of making sulphuric acid, carbon bisulphide, and hydrogen sulphide.

3. Give a general method of obtaining metals from their ores.

4. Discuss the metals of the potassium family, giving their general properties, valence, compounds, and salts that are of chief importance.

5. Upon what property of silver does photography depend? Give a method of separating silver from lead sulphide.

6. What relationship exists between the atomic weights and specific heats of the elements.

7. How is sugar obtained from the cane?

8. A sample of natural gas contains marsh gas, CH_4, 60 per cent.; hydrogen, H_2, 29 per cent.; ethane, C_2H_6, 8 per cent.; olefiant gas, C_2H_4, 1 per cent.; oxygen, O_2, 1 per cent.; and carbon (ous) mon-oxide, CO, 1 per cent. Required the volume of dry air, at 50 degrees C. and 700 mm. pressure necessary, for the complete combustion of one kilogram of the gas.

ELECTRICITY.

FOURTH YEAR CLASS—MAY 21, 1906.

1. A building had been wired for 50 volts, but was subsequently connected with a 110 volt system. If an equal number of lamps, of the same candle power and wattage, is installed, how will the drop compare with the loss if 50 volts had been used? What proportionate increase in the number of lamps could be made without exceeding the drop as calculated for the 50 volt circuit?

2. How can a simple ground detector be made with ordinary lamps? Sketch the connections for a voltmeter ground detector.

3. A 125 volt lighting circuit has an insulation resistance of 0.15 megohm between the conductors and 0.2 megohm between the conductors and the ground. If the testing voltmeter has a resistance of 18,000 ohms, what readings would be observed in making the test?

4. What are the connections for the two principal running points on both the General Electric and the Westinghouse controllers? Sketch the connections for each position, showing clearly the two motors and their fields.

5. A trolley line is 5 miles long. The section composed of the two miles most distant from the power house is supplied by a separate feeder. If 5 cars, each requiring 500 volts and 50 amperes, are to be operated on this section, what additional electromotive force must be supplied by a booster, the feed wire having a section of 515,216 circular mils, and the generator furnishing 550 volts?

6. An alternator makes 200 revolutions per minute and has a frequency of 60 cycles per second. It is of the revolving armature, salient pole type, each armature pole having 50 turns. What must be the flux at each pole to produce 2500 volts?

7. Describe the rotor of an induction motor. Show by diagram the action of the phase-splitter when a single-phase current is used.

8. A star-connected three-phase alternator gives a difference of potential between the conductors of 1000 volts. What is the electromotive force of each circuit of the armature? What power would be required to operate the alternator when delivering 150 amperes on each circuit, its efficiency being 90 per cent. and the power-factor of the load 80 per cent.?

LITERATURE.

THIRD YEAR CLASS—FEBRUARY, 1904.

I.—What is the source of the story of "Macbeth", and what changes did Shakespeare make in dramatizing it?

II.—Tell in detail how Lady Macbeth overcame Macbeth's scruples against murdering Duncan.

III.—Trace Macduff throughout the play.

IV.—Why does Macbeth conceal from Lady Macbeth his intention to murder Banquo?

V.—What is the dramatic significance of the first words spoken by Macbeth in the play? What is the dramatic purpose of the conversation between Lady Macduff and her son?

VI.—Define the following terms, illustrating your definitions by referring to incidents, situations, or circumstances in the play: Complicating Circumstances; Resolving Circumstances; Climax; Catastrophe.

VII.—Explain, by comment or paraphrase, the following passages:

(a) "There's no art
To find the mind's construction in the face."
(b) "Or memorize another Golgotha."
(c) "The near in blood, the nearer bloody."
(d) " To all and him we thirst, and all to all."
(e) "Ere to black Hecate's summons,
The shard-borne beetle with his drowsy hums
Hath rung night's yawning peal . . . ."

VIII.—Account for the fact that our greatest dramas were written in the Elizabethan age.

IX.—Discuss in a theme of not less than 300 words, one or more of the general characteristics of Shakespeare's plays.

LITERATURE.

THIRD YEAR CLASS—JUNE, 1904.

I.—Compare L'Allegro and Il Penseroso as companion poems, showing in some detail the correspondence in structure and the difference in subject-matter and mood.

II.—

"Or whether thou, to our moist vows denied,
Sleep'st by the fable of Bellerus old,
Where the great Vision of the guarded Mount
Looks toward Namancos and Bayona's hold."

Locate this quotation and explain the allusions.

III.—Discuss the difference between the Mask and the Drama.

IV.—Explain or comment upon the meaning of the following words or phrases;

(a) *Once more*, in "Yet once more, O ye laurels——;"
(b) buxom; (c) Friar's lantern; (d) weeds of peace; (e) massy proof; (f) curfew; (g) storied windows richly dight; (h) ruth; (i) darkest grain.

V.—Answer (a) or (b): (a) Account for the fact that Burke never attained a Cabinet position. (b) Outline the "Statement of Facts" in the "Conciliation."

VI.—In the early part of the speech, what reasons does Burke allege against the employment of force? Had he chosen to place these reasons elsewhere, what could have been the proper place for them? Why?

VII.—Compare, as literary periods, the first forty years of the eighteenth century and the first forty years of the nineteenth.

SPECIMEN ENTRANCE EXAMINATION PAPERS.

Set for Pupils Other Than Those Entering from
the Grammar Schools.

SPELLING AND PENMANSHIP.

Writing from dictation a paragraph or two of some standard text—Irving's Rip Van Winkle or Bancroft's United States History.

GRAMMAR.

I.—Use each part of speech in a different sentence, indicating the part of speech used in each sentence by underscoring and naming it.

II.—Define and give an example of a simple sentence, of a complex sentence, and of a compound sentence.

III.—Parse the underscored words in the following sentence: "By not heeding the counsels of our elders, how often do we lose what we should gain."

IV.—Analyze the following sentence: "If we send the sailors a message in time, they will help us when the savages attack us."

V.—Write sentence illustrating the correct use of any perfect tense of each of the following verbs: sit, set, seat, lie, lay, write, go.

COMPOSITION.

The subject set is a description of some well-known place or object, or an account of some historical event.

UNITED STATES HISTORY.

I.—What country was each of the following explorers serving when he came to America, and what territory did he discover or explore: Columbus, De Soto, Drake, Cartier.

II.—Name the principal causes and the principal results of the French and Indian War.

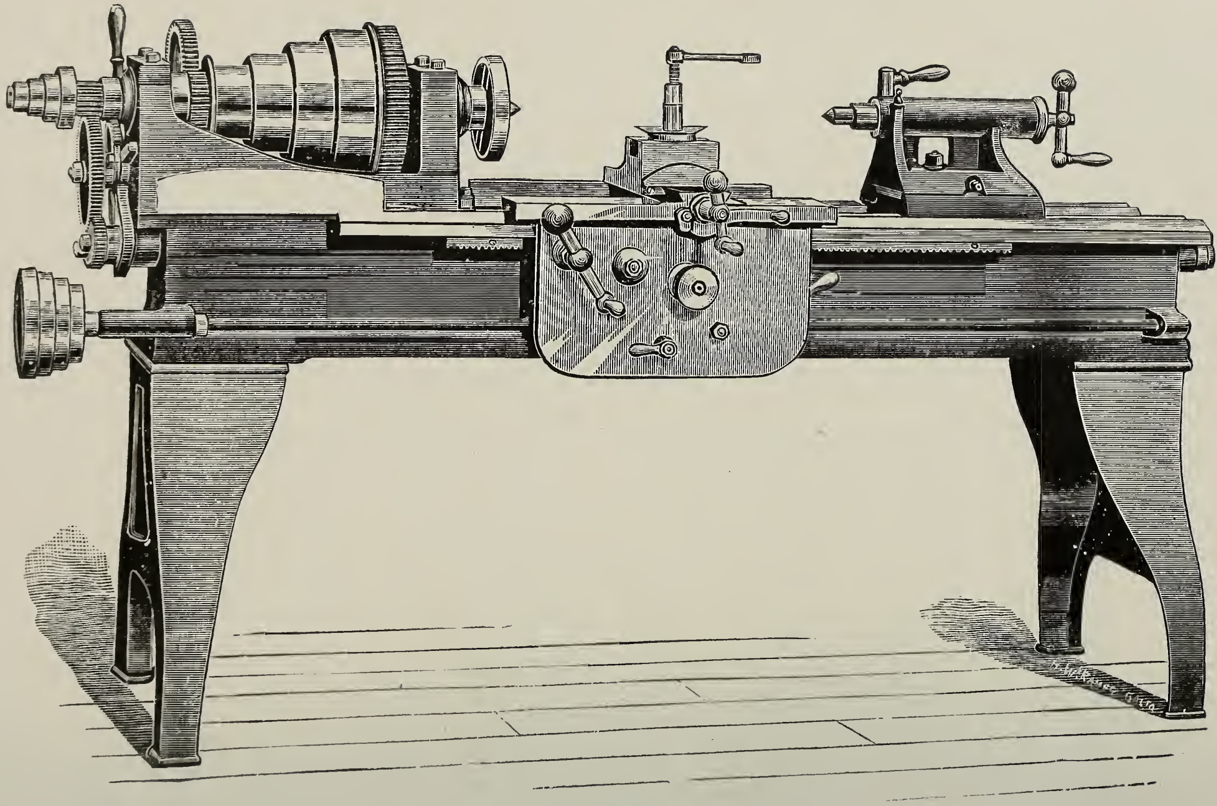
III.—State several causes of the Revolutionary War.

IV.—What were the "Articles of Confederation," and why, and by what, were they superseded?

V.—What is meant by "The Missouri Compromise?"

VI.—Give a short a short account of the "Nullification" incident.

VII.—What was the most important result of the Mexican War?



BUILT BY STUDENTS.

VIII.—Name the principal causes of the Civil War. Who commanded on each side at Gettysburg? Why was the battle of Gettysburg so important?

IX.—What reason did the United States assign for going to war with Spain in 1898? What territory did the United States acquire as a result of that war?

ARITHMETIC.

1. Divide 1.80985965 by 132.8825, deriving the exact result.

2. Simplify $\frac{7}{3}$ of $\frac{21}{4} + \dfrac{\frac{9}{2} - \frac{3}{10}}{\frac{7}{5} - \frac{13}{15}} - \dfrac{\frac{27}{4}}{\frac{1}{4} \times \frac{8}{3}}$.

3. Find the proceeds of a note for \$625.32 due in 60 days, at 5% interest, dated August 1, 1904, and discounted at bank on September 21, 1904, at 6%.

4. Find the cost of paving with brick, 8 inches by 4 inches, a walk 3 feet wide around a rectangular court 20 feet by 18 yards, if the brick cost \$12.37½ per M.

5. A firm sold an engine for \$7,050, thereby losing 6%; for what should it have been sold in order to gain 12%?

6. A merchant's sales on Monday amounted to \$385.84. His sales on Monday were 16⅔% of 54% less than the amount of goods sold on Tuesday. What was the amount of Tuesday's sales?

ALGEBRA.

1. Factor the expressions: $a^2 + 6ax + 5x^2$, $n^{10} - 16n^5 - 80$, and $1 - 9x - 36x^2$.

2. Simplify $\left[(a^2-x^2) \div (\frac{1}{x} - \frac{1}{a})\right] - \left[(a^2-x^2) \div (\frac{1}{x} + \frac{1}{a})\right]$

3. Given $\frac{2x+1}{5} - \frac{3y+2}{7} = 2y - x$, $\frac{3x-1}{4} + \frac{7y+2}{6} = 2x - y$, find the values of x and y.

CATALOGUE OF STUDENTS.

(Corrected to November 15, 1906.)

Students whose names are marked with an asterisk (*) received 85% or more of the possible multiple for the year.

CLASS OF 1907—55 MEMBERS.

Theodore Ascherfeld,
Ludwig Aull,
Emil G. Bauersfeld,
Raymond M. Bealer,
Isador Behrman,
*Alvin M. Bland,
*Gustav Bornscheuer,
*J. Daniel Brendel,
*John N. Childs,
*Wilmer A. Dehuff,
C. Lehman Downs,
Howard A. Essig,
*Herbert S. Fairbank,
*F. Donald Fenhagen,
Otto A. Geumann,
Charles E. Grimes,
Henry R. Gundlach,
*G. Herman Guttmann,
*Carroll R. Harding,
William Hartman,
Horace K. Hayden,
Guy L. Hess,
Harry L. Hess,
*F. Merrill Hildebrandt,
Fernando Janer,
Harry B. Joyce,
Laurence A. Kahn,
John P. Kenney,
Charles Krausse,
William H. Krüger, Jr.,
*William G. McLaughlin,
Laurence F. Magness,
Joseph C. Manning,
Lawrence G. Miller,
*Charles E. Mitchell,
Serafin M. Montesinos,
George T. Mumma,
Marcus Newhoff,
Samuel P. Nixdorf,
Arthur Norden,
Edwin H. Nordmann,
Charles J. Rasch,
*Charles J. Ritterhoff,
Ernest Rodemeyer,
George H. Schlutter,
Arthur H. Schultz, Jr.,
Nelson Schuster,
Frederick B. T. Siems,
V. Bernard Siems,
Charles Silver,
Samuel F. Tapman, Jr.,
T. Leonard Walter,
*Bernard Wich,
R. Mason Wilhelm,
*Julius Zieget.

CLASS OF 1908—85 MEMBERS.

Otto E. Adams,
*Gelston H. Armstrong,
Cullum S. Benson,
Clarence Bolgiano,
Gilbert F. Bolgiano,
C Clarence Boyd,
Wilbur L. Brooks,
*Emmitt B. Bryan,
Charles H. Buck,
Joseph D. Bullock,
*Nathan R. Butler, Jr.,
Walter S. Byrne,
James R. Carroll, Jr.,
Thomas D. Conn,
Joseph W. Cushing,
Percy Davenport,
*Franklin Davis,
Arturo Diaz,
*Raymond G. Ehrman,
William H. Eichner,
Jacob Frey, Jr.,
*Austen Gailey,
Frank Goldenberg,
Eugene E. Graham,
*T. Douglas Cresham,
*R. Milton Hall,
Walter L. Heathcote,
Bertram E. Heinz,
*Walter F. Heise,
Harry C. Hess,
Harry W. Hill,
*Milton A. Hodes,
Abraham A. Hollander,
*Henry J. Horn,
*Raymond H. Hoskins,
William A. Hubbard,
Henry A. Israel,
*Wilbur C. Jackson,
Manual Janer,
Henry Janney,
*Irving Johnson,
Charles R. Justi,
Ernest F. Knabe,
*Walter E. Lee,
Andrew H. Lemmon,
*Fred. W. Lieberknecht,
Thomas W. Manning,
Thomas Mayer, Jr.,
Thomas B. Meushaw,
Richard C. Meyer,
Clarence Nagle,
Robert E. Pallé,
Allen H. Potts,
*Mitchell W. Price,
F. Edward Rasmers,
James P. Ray,
William F. Reed,
Norman G. Reinicker,
Herbert B. Reynolds,
Norman F. Rigor,
*Edwin Rolker,
Gustav W. Schindhelm,
Raymond Schlegl,
*Christian Schluderberg,
*Othello Schroedl,
*Arthur G. Schuster,
Louis C. Schwartz,
Emil Sedlacek,
Harry M. Siegel,
Otto Sima,
Carlos A Soler,
Benjamin F. Starr, Jr.,
Milton D, Swartz,
William F. Tapking, Jr.,
William A. Tjarks,
*Walter M. Troll,
Henry Vogt,
Romain G. Waltenberg,
*Carl C. S. Walter,
Raymond C. Webber,
Craig McM. Wills,
Charles E. Woollen,
Luther Chase Wright,
*Martin Wright,
Fred. A. Zscheuschler,

CLASS OF 1909—116 MEMBERS.

Frederick B. Abbott,
Frank Beehler,
Howard V. Bell,
John A. Bennett,
Ralph G. Bittle,
Morris Block,
Oscar M. Block,
Ralph C. Bolgiano,
*George Borst,
Ralph G. Braun,
*Frederick Burggraf,
Harry U. Butler,
Maurice C. Butler,
Edward E. Calder, Jr.,
Carlton DeV. Cann,
Arnold W. Carnan,
*Ralph W. Cathell,
George A. Chase, Jr.,
Oliver Conradi,
Douglas C. Corner,
J. Marion Creamer,
*Louis Cremona,
Harry W. Crist,
*W. Norman Crist,
Willian D. Dalrymple,
*Louis A. Deliz,
Roger B. Drenning,
Auville Eager,
Frank Fahm, Jr.,
Clarence J. Flayhart,
Roy D. Fleckenstein,
*George C. Fultz,
G. Morrison Gaither, Jr.,
H. Nelson Gambrill,
*Wilson N. Gambrill,
*Raphael Garcia,
Charles R. Geisz,
George E. Gerlach,
Ray Y. Gildea,
George S. Giles,
*John Glaeser, Jr.,
William Hanzsche,
Lester P. Henderson,
Frank P. Herrmann,
Gustav A. Herth,
*Elmer Heubeck,
Walter E. Higham.
*James R. E. Hiltz,
William V. Hipsley,
Franklin E. Holland,
Adam W. Jahn,
Arthur Janushek,
Arthur Johnstone,
Morris G. Jory,
J. Lawrence Keck,
Edward M. Kennard, Jr.,
Thomas M. Kenny,
Philip P. Kesler,
*Robert W. Keyes,
*Roger Knipp,
Gibbs LaMotte,
Louis E. Lamborn,
William D. Lamdin,
Harrison M. Langrall,
*H. S. Blackwell Latham,
Mariner Laurence,
John P. Link,
Thomas M. Linthicum,
G. Bernard Lohmuller,
Harry London,
William J. Mason,
*R. Brooke Maxwell,
James T. McCarthy,
Ridgaway R. Merryman,
*Henry C. A. W. Meyer,
H. Osborne Michael,
Joseph R. Michel,
William R. Milburn,
*Julins O. Mirski,
Alfred Mullikin,
Arthur B. Nickerson,
*Emory H. Niles,
Alfred Nisbet,
Walter F. Perkins,
Edgar A. Pfeil,
C. Herbert Pund,
Frederick L. Purdy,
Herbert C. Randall,

Arthur S. Richmond,
Paul Rosenthal,
David W. Shilling,
Harry B. Siegmund,
John L. Siems,
W. H. John Siems,
Ernest Southerington,
Frederick C. Stauffen,
Samuel P. Stewart, Jr.,
Lawrence C. Stoudenmire,
*John Snyder,
*John C. D. Taylor,
Herbert M. Thomas,
Leroy Thompson,
Francis J. Thomsen, Jr.,
*H. Belin Tinges,
Horace C. Turner,
Robert B. Turner,
Wilbur N. Van Sant,
Manuel L.Vicente,
Philip Waldschmidt,
Herbert L. Weaver,
Russell D. Welsh,
Hermann A. Weighardt,
William D. Wilson,
*Bertram S. Winchester,
J. Edward Yewell,
August C. Yockel,

MID-YEAR CLASS OF 1910—50 MEMBERS.

Joseph Aaron,
Edgar B. Allison,
Karl C. Ascherfeld,
Barry Black,
John G. Bobb,
Clarence G. Boggs,
J. Edgar Bryan,
William H. C. Burke,
Harry C. Clark,
August P. Clarson,
Edward O. Doeplitz,
Bowie G. Echison,
George E. Green,
Frederick Hall,
Seymour I. Hess,
Charles H. Hillegeist,
Albert G. Karl
John L. Krausz,
Edward H. Lange,
Joseph H. Letzer,
Edmund J. Little, Jr.,
Richard V. Mossop,
Charles F. O'Donnell,
Orlandc B Platt,
James R. Plitt,
Stephen W. Price,
James B. Pryor,
Ramsay G. Regester,
Mark Rigor, Jr.,
Charles E. Roberts,
John J. Rodemeyer,
Herbert Sadtler,
Albert H. Samuel,
William S. Saunders,
Lewis N. Scherf,
Carl K. Schulte,
Walter R. Sewell,
George F. Shaw,
Morris A. Spamer,
Milton C. W. Strobel,
George J. Sturmfelz, Jr.,
Frederick H. Sweeney,
Raymond W. Thompson,
Robert W. Tippet,
Nathan Ullman,
George W. Van Daniker,
John F. Wannenwetsch,
Frederick Wanstall,
Richard H. Williams, Jr.,
Donald B. Wood,

CLASS OF 1910—240 MEMBERS.

Edwin Akers,
Laurence Albaugh,
Robert Aler,
Harry W. Ament,
Eugene W. Anderson,
Philip S. Andrews,
Hammond Anstine,
William H. Askew,
Willard Atkinson,
Alois Baer,
John Robert Baer,
Nelson W. Baldwin,
William H. Barnard, Jr.,
John G. Bauernschmidt,
John Z. Bayless,
Walter E. Beck,
Emory W. Benson,
Ira L. Berg,
Charles F. Bevan,
Robinson J. Binau,
Leo Blankman,
Jacob Blaustein,
James G. Bode,
Alfred J. Bohn,
Benjamin F. Bond,
Frank M. Boyd,
William C. Brooks, Jr.,
Edward L. Brown,
John B. Brown,
Marion L, Brown,
Walter A. Brown,
Harold A. Calkins,
William H. Callahan, Jr.,
Howard Fulton Carr,
Wilmer C. Carter,
Laurence B. Chenowith,
French W. Chidester
Raymond A. Christy,
Alfred A. Clark,
John W. Clark,
Guy Clemmitt,
Howard Leeds Cole,
Emory S. Collins,
C. Carroll Collmus, Jr.,
Harry H. Comer,
Howard T. Cromwell,
Lewis T. Crosby,
Lister M. Cummings,
Dorsey A. Davis,
Allen M. Delauney,
G. Mason Dewlin,
William Norris Dunning,
John R. Eccleston,
Charles A. Ehmling,
Herbert A. Ehrman,
Ernest W. Eickleberg,
Frank C. Eleder.
William M. Farley,
George B. Farlow,
Harry J. Faust,
William H. Fenker,
George E. Finck,
Edgar M. Fluharty,
Leon W. Frederick,
Charles V. French,
Harry J. Funk,
Harry B. Gaither,
William D. Gardner,
Harry E. Gareis,
Vernon Garrison,
Egan A. Geller,
Andrew E. George,
Reid Gettier,
Edgar A. Gilbert
Frank Giuliani,
August P. Gompf,
William R. Greer,
William Gronert,
Howard L. Gugel,
Julius F. Haegel,
Charles E. Hahn, Jr.,
E. Ellsworth Hall,
Oscar A. Hallwig,
Charles H. Hammann,
Edward L. Harp, Jr.,
Carroll T. Harris,
Gustav Heinz,
Robert Held,
Kaswell R. Henthorn,

Rufus Hertel,
Carl Hofmann,
George H. Hohman,
Arthur F. Holston,
Hamilton A. Hooper,
Parr Hooper,
Herrmann S. Hutchins,
Luther Immler,
Albert C. Johnson, Jr.,
Charles R. Johnson,
George Johnson,
Newman Johnston,
William B. Jonnston,
Frederick H. Jones,
John Kavanaugh,
Charles Keagle,
Thomas A. Keelan,
Thomas E. Keen,
George J. Kelly,
Leon R. Ketcham,
Paul E. Kiefer,
Donald N. Kirwan,
Edwin F. Koester,
Edward M. Kranz,
Robert W. Kroeger,
Harry F. Krumm,
August J. Kutzleb,
George M. Laufer,
Charles R. Lawson,
Adolph W. Lederer,
Walter Lee,
Roger L. Leilich,
Walter H. Leisure,
Louis Linde,
Charles L. Linhardt,
Lewis W. Link,
William H. Long,
Lucien C. Lowndes,
William R. Lucke,
Edward D. Lynch,
Howard B. Lyon,
Charles LeR. Maas,
Manuel E. Mallen,
Louis Mardaga,
Jesse H. Mason,
Paul Mason,
Charles N. Matthews,
Walter H. Mays,
Harry R. McCawley,
William E. McComas, Jr.,
Edward O. McDonnell,
William M. McGinnis,
Eugene D. Milener,
Henry G. Miller,
Charles W. Miller,
Albert L. Moog,
Raymond Murphy,
Joseph M. Murphy,
Carlisle Needham,
William N. Neibich,
John P. Nelson,
Frank A. Newmann,
Frank A. Nichols,
Dudley F. Nicholson,
John Byrd Norris, Jr.,
Warren Norris,
William B. O'Connor,
Morris Oppenheimer,
William H. Orem,
Philip Overbeck,
John Marshall Page,
G. Edgar Parrish,
Albert C. Pearson,
James W. B. Phillips,
Ferdinand H. Plack,
Lawrence P. Pleasants,
Edwin A. Plitt,
John B. Posey, Jr.,
George J. Ramming,
Norman R. Randle,
Roswell H. Rausch,
Charles M. Reed,
George C. Rein,
Richard G. Reese,
Vernon C. Reynolds,
Arthur Rhoades,
Lee Robinson,
Iver Rosendale,
Charles W. Roth,
William A. Roth,

John K. Ruff,
Andrew E. Rutter,
Edward LeR. Rutter,
Benjamin Samler,
Arthur H. Schaefer,
Bernard J. Schmidt,
Charles Schmidt,
Jacob Schmidt,
Harry Schneider,
Luther W. Scott,
William O. Seippel,
Oliver Shepard,
Frank Shoewalskey,
Harry G. Siems,
George W. Slee,
Montgomery J. Slingluff,
Thomas C. Slingluff,
William R. Smoot,
William W. Southard,
Norman Stansbury,
Charles L. Steele,
Fletcher F. Steele,
William Steiger,
Wallace Steiger,
Jay W. H. Stoudenmire,
John L. Strube,
George W. Tall, Jr.,
Albert H. Taylor,
Perry McK. Teeple,
William Thiemeyer,
John A. W. Thomas,
Millard B. Thomas,
Russell R. Tower,
Harold Tschudi,
Walter E. Tucker,
Carroll A. Turner,
Percy P. Turner,
Leo Tyser,
Harry L. Voelker,
Charles P. Vogel,
M. Leeson Walsh,
DeFord Weil,
Frank I. Wheeler, Jr.,
Paul Whittington,
Frank C. Williams,
Fletcher R. Williamson,
Gilbert P. Wilmot,
Donald Wilson,
William V. Winchester,
Eugene L. Wolfe,
Smallwood L. Wolfe,
Charles E. Wood,
John A. Woodfield,
Henry L. Wortsche,
Philip C. Wroe,
Merrill Yeadaker,
Roy A. Yingling,
Leroy R. Young,
William E. Zerkle,
Julius O. Ziegfeld,
Thomas J. Zimmermann.

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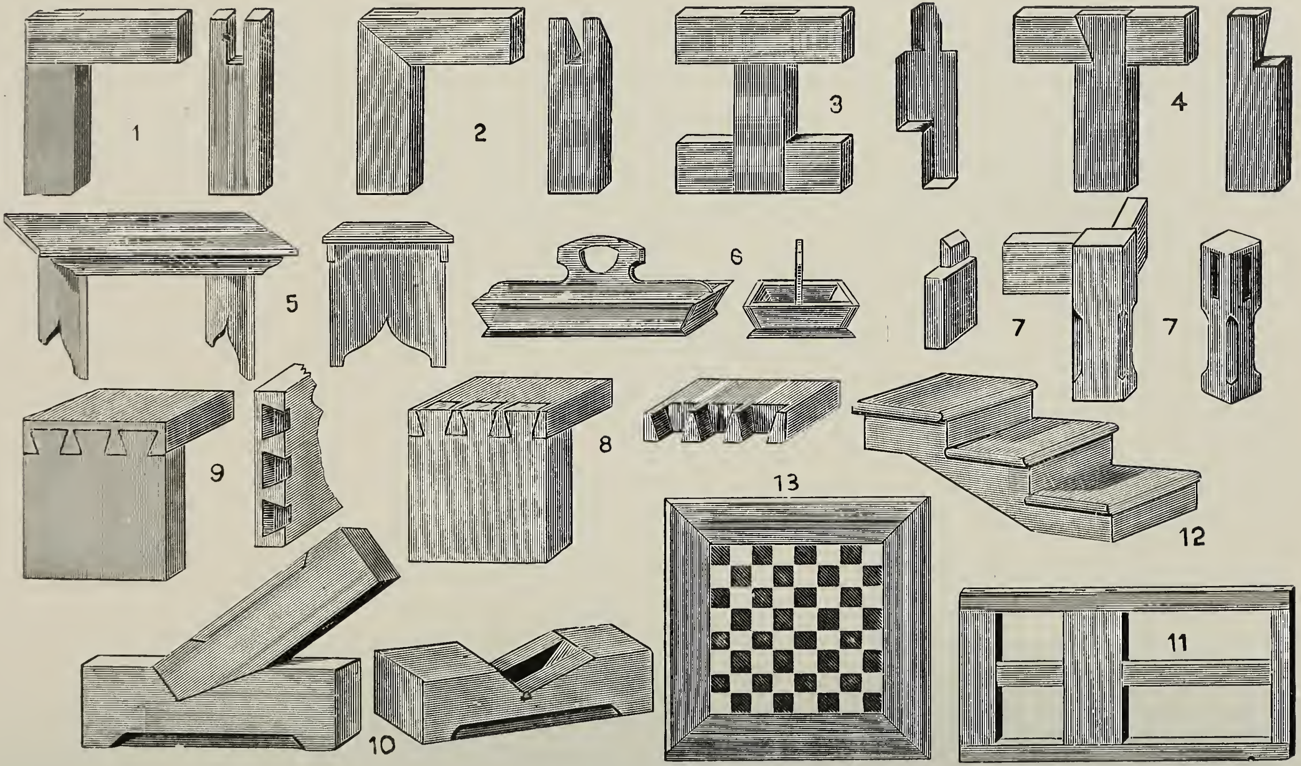

CARPENTRY.

SUMMARY OF ENROLLMENT.

Class of 1907	55
Class of 1908	85
Class of 1909	116
Mid-Year Class of 1910	50
Class of 1910	240
Total enrollment	546

CLASS ORGANIZATIONS.

CLASS OF '07.

President	Charles E. Mitchell.
Vice-President	Herbert S. Fairbank.
Secretary	Julius Zieget.
Treasurer	Bernard Wich.

CLASS OF '08.

President	Irving Johnson.
Vice-President	Henry A. Israel.
Secretary	Richard C. Meyer.
Treasurer	William A. T. Tjarks.

CLASS OF '09.

President	Elmer Heubeck.
Vice-President	Gibbs LaMotte.
Secretary	Geo. A. Chase.
Treasurer	Robert B. Turner.

CLASS OF '10.

President	Lister M. Cummings.
Secretary	Carroll A. Turner.
Treasurer	Guy Clemmitt.

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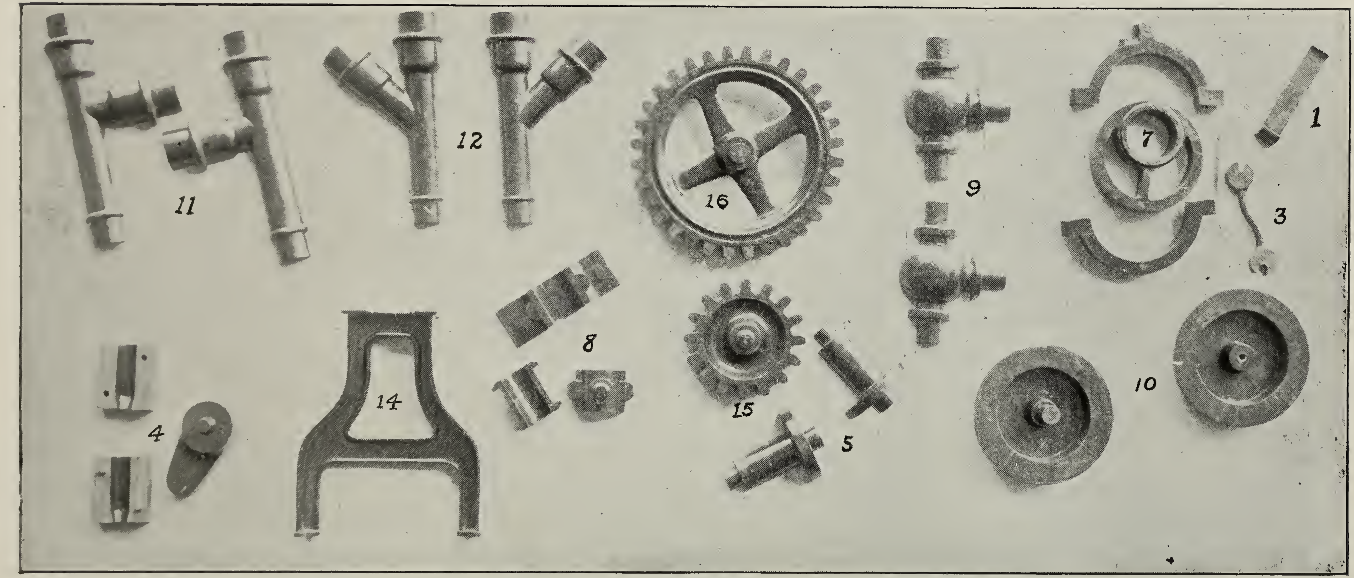


PATTERN WORK.

LITERARY SOCIETIES.

THE "LOWELL."

President	Nelson Schuster, '07.
Vice-President	Arthur Schulz, '07.
Secretary	Emory H. Niles, '09.
Treasurer	J. Barry Black, '10.
Sergeant-at-Arms	Lawrence P. Pleasants, '10.
Reporter	Perry Teeple, '10.
Executive Committee	J. C. D. Taylor, '09.
	Samuel P. Nixdorf, 07.
	The President, *ex-officio*.

THE "POE."

President	Frank Reed, '08.
Vice-President	Wilmer A. Dehuff, '07.
Secretary	John N. Childs, 07.
Treasurer	Harry C. Hess, '07.
Reporter	Raymond Bealer, '07.
Executive Committee	Frank Reed, '08.
	Raymond G. Ehrman, '08.
	Charles H. Buck, '08.

On June 15, 1906, at the Western High School, the "Lowell" and the "Poe" gave a performance of "She Stoops to Conquer," in which all the parts were taken by members of the two societies.

ATHLETICS.

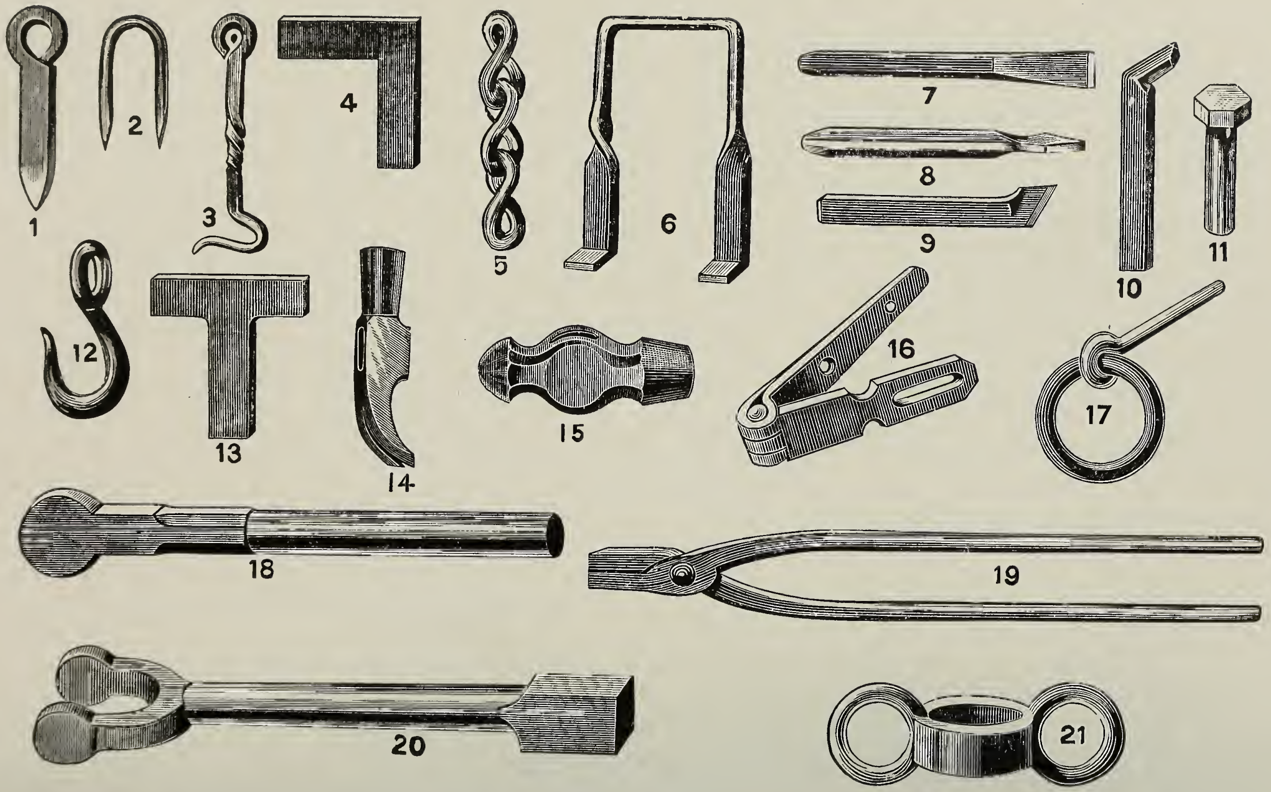
ATHLETIC ASSOCIATION.

President	C. E. Mitchell, '07.
Vice-President	Guy L. Hess, '07.
Secretary	Elmer Heubeck, '09.
Treasurer	Lawrence P. Pleasants, '10

ATHLETIC BOARD.

Guy L. Hess, '07.
Theodore Ascherfeld, '07.
C. E. Mitchell, '07.
E. B. Bryan, '08.
W. T. Tjarks, '08.
Andrew H. Lemon, '08.
Gibbs LaMotte, '09.
Elmer Heubeck, '09.
Roger B. Drenning, '09.
Lister M. Cummings, '10.
Lawrence P. Pleasants, '10.
J. Edgar Bryan, '10.

Thomas F. Garey, from the Faculty.
Charles R. Gantz, from the Alumni.



FORGE WORK.

FOOTBALL.

The football season of 1905, while not prolific in victories as shown by the scores, was yet eminently successful in that the experience and training gained in lining up against heavier teams in the early part of the season enabled the team to come nearer than ever before to their ultimate goal in the final game of the year. The line-up of the team was:

Clemmitt	Left End.
Carl	Left Tackle.
Heubeck (Hebden)	Left Guard.
Virgin	Centre.
Benson (Lanahan)	Right Guard.
Mitchell	Right Tackle.
Bryan	Right End.
Tauszky (Captain)	Quarter Back.
Aull (Hess)	Right Half Back.
Swartwout (Thomsen)	Left Half Back.
Henderson	Full Back.

Substitutes—Latham, Haswell, McCormick, Herring and Miller.

The following is a Summary of the games played:

Oct. 7, at College Park: Polytechnic, 0; Md. Agricultural College, 20.
Oct. 14, at Port Deposit: Polytechnic, 0; Tome Institute, 11.
Oct. 28, at Ellicott City: Polytechnic, 6; Rock Hill College, 6.
Nov. 4, at Druid Hill Park: Polytechnic, 5; Ruxford Athletic Club, 0.
Nov. 8, at Walbrook: Polytechnic, 0; Boys' Latin School, 6.
Nov. 11, at Chestertown: Polytechnic, 0; Washington College, 2d, 11.
Nov. 15, at Clifton Park: Polytechnic, 0; Loyola College, 0.
Nov. 17, at Country School: Polytechnic, 5; Country School, 11.
Nov. 30, at Annapolis: Polytechnic, 0; Naval Academy Plebes, 16.
Dec. 9, at Maryland Oval: Polytechnic, 4; Baltimore City College, 6.

The official "P" was awarded to the following in football:

Clemmitt, Carl, Heubeck, Virgin, Benson, Mitchell, Bryan, Tauszky, Aull, Swartwout, Henderson, Lanahan, Hess, Hebden and Thomsen.

The secondary honor, "P. A. A.," was awarded to the following:

Latham, Haswell, McCormick, Herring and Miller.

THE ORCHESTRA.

Director	Fernando Janer, '07.
Manager	Julius Zieget, '07.

Fernando Janer, '07	*Flute.*
Julius Zieget, '07	*First Violin.*
Isadore Behrman, '07	*First Violin.*
William Eichner, '08	*Second Violin.*
Lawrence Magness, '07	*Second Violin.*
Serafin Montesinos, '07	*Clarinet.*
Louis Schwartz, '08	*Cello.*
Walter Heise, '08	*Cornet.*
C. C. S. Walter, '08	*Piano.*
Lewis A. Deliz, '09	*Oboe.*

THE MANDOLIN CLUB.

Manager	Serafin M. Montesinos, '07.
Director	Isadore Behrman, '07.
Secretary	John N. Childs, '07.
Treasurer	Lawrence Stoudenmire, '09.

Violins :

Isadore Behrman, '07.
Julius Zieget, '07.
Lawrence Magness, '07.

First Mandolins:

George A. Chase, '09.
Alfred Mullikin, '09.
Jay Stoudenmire, '10.
Charles W. Miller, '10.
Serafin M. Montesinos, '07.
Arthur H. Schultz, '07.
Fernando Janer, '07.

Second Mandolins:

Lawrence C. Stoudenmire, '09.
Frank A. Neumann, '10.

Banjos:

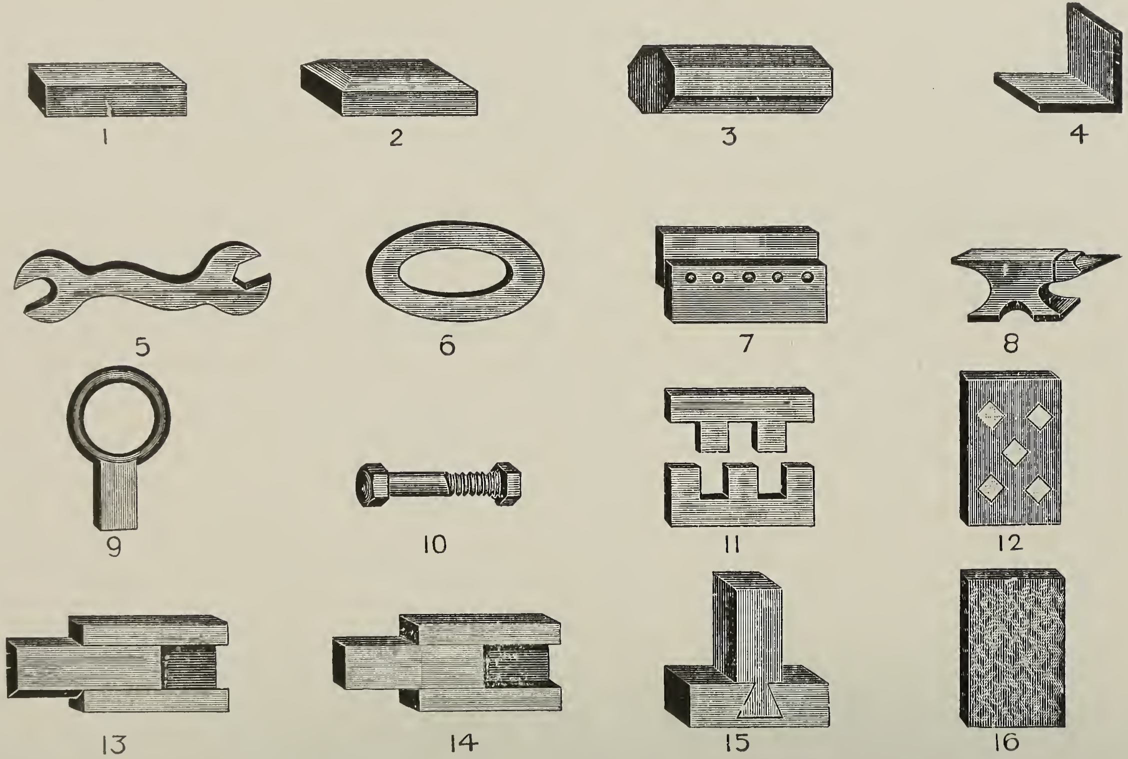
F. Donald Fenhagen, '07.
Carlos A. Soler, '08.

Guitars:

Daniel Brendel, '07.
John N. Childs, '07.
Henry A. Israel, '08.

Pianos:

Carl C. S. Walter, '08.
Samuel P. Nixdorf, '07.
Henry R. Gundlach, '07.



VISE WORK.

THE CHESS CLUB.

President	Gelston H. Armstrong, 08'.
Vice-President	Bernard Wich, '07.
Secretary	Charles E. Grimes, '07.
Treasurer	Charles Silver, '07.
Reporter	Raymond M. Bealer, '07.
Sergeant-at-Arms	Craig McM. Wills, '08.
Executive Committee	Bernard Wich, '07. Charles Silver, '07. The President, ex-officio.

The Baltimore Polytechnic Institute Chess Club was organized on November 29, 1905. In March, a tournament was held by this club and the two participants having the best scores were awarded prizes. During April, 1906, in a contest with the Baltimore City College Chess Club, the "Polys" scored three points against two by their opponents, thus winning the match.

CATALOGUE OF GRADUATES.

CLASS OF '87.

Clarence G. Bouis,
George C. Bump,
Lucien Dallam,
Otto H. Ehlers,
Osma K. Gardner,
Herbert F. Gorgas,
Joseph Greenbaum,
Henry W. Hahn,
Minor F. Heiskell,
Robert Hooper,
William S. Hugg,
Thomas J. Irons,
Joseph H. Kuehn,
P. Charles Nelson,
Flavius J. Pennington,
Richard Piez,
Henry M. Price,
Walter G. Reinicker,
William A. Robertson,
Albert Rosenberg,
James B. Scott,
Walter R. Sweeney,
James C. Thompson,
Adolphus Tiemeyer,
Frederick H. Wagner.

CLASS OF '88.

Arthur O. Babendrier,
Edward Binswanger,
Bernard H. Brooke,
Sydney S. Bouis,
Julius Fireman,
Thomas G. Ford,
George M. Gaither,
John H. Harvey,
Howard Harvey,
Walter J. Herrman,
Joseph H. Hooper,
John P. Jefferson,
William Johnston, Jr.,
William Mencke,
William F. Mylander,
Edwin F. Orem,
Edward B. Passano,
George E. Repp,
Harry E. Roberts,
George C. Robinson,
Hanson Robinson,
Robert E. Rodgers,
George H. Sickel,
Washington B. Stanton,
Orlando C. Weeks.

CLASS OF '89.

William F. Ackerman,
Samuel R. Adams,
Morgan H. Baldwin,
Isaac Behrend,
Louis H. Gerding,
Arthur Gordon,
Ernest Griffith,
John S. Hand,

Joseph Isaac,
Claiborne M. James,
Albert C. Layman,
Charles W. Leach,
J. W. C. Meikle,
Rozier L. Bouis,
Robert H. Buschman,
Charles C. Constantine,
Albert T. Barrett,
John L. Ehrman,
Allyn Field,
Harry M. Ford,
Edward P. Cromwell,
Howard Crosby,
George W. Moog,
John K. Mount,
Robert W. Peach,
Charles E. Phelps, Jr.
William G. Robertson,
Robert C. Round,
Myron S. Rose,
William C. Siegmund,
Joseph Steifel,
Harry P. Suman,
Carroll Thomas.

CLASS OF '90.

John F. Abendschein,
G. S. Barnes,
J. H. Bokee,
J. Edward Broadbelt,
W. H. Fahrinholt,
Chris. Feick,
J. Froelich,
William P. Gundry,
E. C. Harris,
J. C. Mattoon,
John D. Pugh,
A. O. Robertson,
William F. Schultz,
Michael D. Schaefer,
William P. Shriver,
Theodore Straus.

CLASS OF '91.

Walter Amos,
Basil Benson,
William Benson,
William Boucsein,
Morde Bren,
John J. Caine,
George Dannettel,
Charles Ehlers,
Ferdinand B. Keidel,
J. Edgar Knipp,
Samuel McNeal,
James C. Phillips,
Herbert M. Reese,
Edmund W. Robinson,
Reuben Row,
Warren S. Seipp,
N. D. D. Sollers,
Richard S. Warner,
William A. Young.

CLASS OF '92.

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John P. Baer,
Frank J. Borie,
B. Harrison Branch,
Leonard Burbank,
William C. Butler, Jr.,
Frank B. Hooper,
Edgar N. King,
John Langford,
Louis Liepman,
R. M. Miller,
J. W. Dawson, Jr.,

Royal R. Duncan,
Charles R. Durling,
Isidor Deutsche,
Walter H. Eisenbrandt,
William T. Holmes,
J. C. Miller,
Joseph Mullen,
William H. Rose,
Albert G. Singewald,
William H. Soine,
William E. Straus.

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Theodore H. Ackerman,
Herbert Addison,
Oregon R. Benson,
Percy Thayer Blogg,
C. Raymond Carson,
William John Cochran,
E. C. D'Yarmett,
Henry M. Fitzhugh,
Clarence S. Hand,
James F. McShane,
Clarence F. Morfit,
F. H. Phelps,
Edwin Schenck,
John R. Uhler,
L. Ismay Van Horn,
Charles P. Weishampel,
R. L. Williams.

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Albert E. Bowen,
J. Straith Briscoe,
Harry Cotton,
Carroll Edgar,
Frederick Kopp,
Philip Littig, Jr.,
Thomas Q. McGinn,
Herbert A. McGaw,
Horace J. Miller,
Louis Mueller,
George M. Parlett,
Charles Schlicker,
Alan P. Wilson,
John Zeubert,
Pliny Cutler Hall,
Edward J. Herring.

CLASS OF '95.

George W. Brown,
Clifton A. Coggins,
Harry W. Francis,
Graham B. Hall,
William W. Hogendorp,
Albert J. Hooper,
Frank A. Hornig,
Howard L. Hoskins,
Edward M. Likes,
Ward P. Littig,
Alfred F. Loeser,
Thomas J. H. Magness,
Herman F. Meyer,
George N. Rogers,
Hamilton D. Ruth,
Richard F. Weishampel,
Carl A. Witthaus.

CLASS OF '96.

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William Augustine Boykin, Jr.,
Robert Lemmon Burwell,
Harry Parr Diggs,
Frederick L. H. Glendmeyer,
William Howard Hamilton,
Arthur Worthington Hawks, Jr.,
Frederick Worthington von Stein,
Louis Kemp Henninghausen,
Harry Louis Homer,
Ludford Cohoon Jones,
Leon Alvyn Kohn,
Erich Albert Loeser,
Henry Louis Mencken,
Harold Vincent Patterson,
Harry Clay Powell, Jr.,
Gilmor Meredith Ross,
Thomas Quincy Scott,
Henry Bonn Silverthorn,
William Henry Smith,
Roscoe Conkling Sweeny,
Charles Edwin Wilson,
Olin Alexander Wilson.

CLASS OF '97.

Louis Fabian Bachrach,
Alan Marion Bennett,
William Melvin Carter,
Elvin Griswold Cromwell,
John Towson Elsroad, Jr.,
John Montgomery Gambrill,
Ernest Cummins Hatch,
William Hain Kirwan,
Harry L. Kugler,
Chester Waters Larner,
Howard Osgood Preston,
George Gottlieb Schnepfe,
Frederick Lewis Schwartz,
Joseph Stewart Smith, Jr.,
Douglas Alan Sparks,
Joseph Morrison Sparks,
Wilson Ward.

CLASS OF '98.

Thomas Jefferson Andrews,
Alan Joseph Bachrach,
Leo Bauerfeld,
Wilbur McKnew Bosworth,
Frederick Derick Dollenberg, Jr.,
Romulus Griffith Doyle,
John Howard Flayhart,
Henry Galloway,
Charles Raymond Gantz,
Samuel Thomas Griffith,
Alfred Cummins Hatch,
William Herman Hubers, Jr.,
Joseph Lowrie Ingle, Jr.,
John Scott Longnecker,
John Walter McGreevy,
Edward Harris Mealy,
William Charles Metcalf,
John Floyd Miller,
William Eldred Nolan,
Gurdon Tyler Pollard,
Walter Percy Poole,
John Maurice Rehberger,
John McCullough Rife,
Harry Rufus Ruse,
Paul Edward Schaun,
John Henry Sirich, Jr.,
John Smith,
Herbert Turner Snyder,
George Creamer Wilcox.

CLASS OF '99.

Charles E. Allen,
William B. Boettinger,
Harrison Brent,
Hugh W. Brent,
Edward Goodnow Clayton,
Edward P. Cooke,
Charles C. Crokett,
William W. Cushing,
Arthur Councilman Davis,
Charles H. Demitz,
Roland S. Focke,
Harry B. French,
Robert B. Harper,
Charles W. Held,
Ira Johnson,
George A. Knapp,
Walter B. Lang,
Harry Lowenthal,
George P. McCeney,
William E. McCord,
Marion H. McCoy,
Charles E. Mencken,
Charles T. Owens,
Edw. L. Schaun,
Harold B. Vincent,
Joseph A. Ward,
Charles C. Lucke,
John N. McCleester,
Blakely A. McDonnell,
Edwin G. O'Conner,
William Taylor Phipps,
Emanuel J. Sedlacek,
Frederick C. J. Sternat,
Joseph R. Walter,
William C. Whelan.

CLASS OF '00.

John Walter Fred. Blizard,
Roy Stevenson Houck,
Galt Fayette Parsons,
Samuel Moore Johnson,
Luther Chase Wright,
Walter Bowen Buttner,
Gustav Frederick Linck,
Horace Kirk Faust,
Thomas Osborn Wansleben,
Morgan Moore,
John Charles Masopust,
Walter Groverman,
Lawrence Gunton Allbutt.

CLASS OF '01.

Joseph M. Beehler,
C. Ernest Conway,
Willim M. Demitz,
Charles F. Goob,
Richard G. Harris,
Irving C. Hess,
Charles W. Hoppert,
Carlisle L. Hubbard,
Edward E. Johnston,
Thomas H. Kenney,
Charles E. Lane,
Andrew J. Lowndes,
Ross E. Lynch,
Allen L. Malone,
Richard E. Marston,
Harry Mehrling,
John A. Raidabaugh,
T. Warden Rinehart,
William B. Rosenthal,
Edward Samuel,
John C. Siegle,
Walter H. Tapman,
Sidney C. Vincent,
George P. von Eiff,
Ernest B. Walton,
Arthur S. Weiss,
George K. Yost,
Philip H. Zipp.

POST-GRADUATE CLASS OF '02.

(Four Year Course.)

Joseph M. Beehler,
C. Ernest Conway,
Irving C. Hess,
Andrew J. Lowndes,
Allen L. Malone,
John A. Raidabaugh,
Sidney C. Vincent,
George P. von Eiff,
Philip H. Zipp.

CLASS OF '02.

Joseph A. Baldwin,
Frank O. Boyd,
John B. Cautley,
Robert Dall,
William L. De Baufre,
John K. Flickenschildt,
Walter M. Gieske,
Donald S. Hays,
Joseph T. Henthorn,
John S. Hess,
I. Seeley Jones,
D. Frank Lamble,
LeRoy M. Langrall,
H. Quimby Layman,
John G. M. Leisenring,
William N. Michael,
Charles A. Pettit,
William S. Samuel,
G. Forney Shryock,
Charles F. Yardley.

POST-GRADUATE CLASS OF '03.

(Four Year Course.)

John B. Cautley,
Robert Dall,
William L. De Baufre,
John K. Flickenschildt,
Walter M. Gieske,
Donald S. Hays,
John S. Hess,
I. Seeley Jones,
LeRoy M. Langrall,
H. Quimby Layman.

Specials { Arthur C. Davis,
Charles A. Pettit.

CLASS OF '03.

Elmer Armiger,
Paul Backhaus,
Oscar F. Benjamin,
Owen C. Blades,
Harry N. Brannan,
Frank B. Burton,
William N. Crisp,
John W. Dorsey, Jr.,
Christopher J. Frank,
Milton H. Gross,
Harold M. Parsons,
Ernest M. Poole,
J. McDonnell Reid,
Martin J. Reynolds,
Edward Hering,
Charles E. Herth,

James B. Jones,
Milton Kraemer,
Herman Lucke, Jr.
Edmund C. Lynch,
Arthur B. Marston,
Harry M. Mason, Jr.
Sidney Newhoff,
Manly P. Northam,
August H. Schaaf,
Howard I. Schultz,
George F. W. Sims,
Wilmer T. Stone.

POST-GRADUATE CLASS OF '04.

(Four Year Course.)

Paul W. Backhaus,
Harry N. Brannan,
William N. Crisp,
Edward Hering,
James B. Jones,
Milton Kraemer,
Harry M. Mason, Jr.
J. McDonnell Reid,
Martin J. Reynolds,
George F. W. Sims,

Specials:
Frank B. Burton,
H. Milton Gross,
August H. Schaaf.

CLASS OF '04.

Chester A. A. Albrecht,
James B. Arthur,
Marion V. Bailliere,
Joseph Bowes, Jr.,
Andrew K. Brumbaugh,
Clarence C. Clickner,
Edward C. Cromwell,
Frederick L. Dixon,
Charles A. Edel,
Frank B. Fifer,
Emanuel Fritz,
George Gittelsohn,
J. Lyell Gressitt,
Edward J. Hecker,
John H. Hills,
Harry J. Hodes,
Benjamin F. Hoffacker,
Harry V. D. Hunt,
William C. Hurley,
Charles A. Langrall,
Herman W. Lasser,
Daniel J. Leary,
Leon Marmor,
Samuel May,
John L. Mosher,
Charles P. Niederhauser,
Robert G. Pangborn,
Massimo Pisani, Jr.,
George S. Robertson,
George M. G. Schaefer,
Leon Small,
Oscar E. Smith,
Marion Steinberger,
Harry D. Thurlow,
Harry Waldorf,
Charles W. Whittle,
Edwin L. Wilson,
Louis A. Witte,
William P. Wittmer,
Alexander H. Woollen.

POST-GRADUATE CLASS OF '05.

Chester A. A. Albrecht,
James B. Arthur,
Joseph Bowes, Jr.,
Edward C. Cromwell,
John W. Dorsey, Jr.,
Charles A. Edel,
Frank P. Fifer,
Emanuel Fritz,
J. Lyell Gressitt,
Richard G. Harris,
Edward J. Hecker,
John J. Hills,
Benjamin F. Hoffacker,
Harry V. D. Hunt,
Charles A. Langrall,
Samuel May,
John L. Mosher,
Robert G. Pangborn,
Massimo Pisani, Jr.,
Leon Small,
Marion Steinberger,
*Harry DeG. Thurlow,
Harry Waldorf,
Edwin L. Wilson,
Alexander H. Woolen.

*Deficient in Mechanics; allowed a reëxamination in September and passed.

CLASS OF '06.

H. Roy Anderson,
Moses Appel,
Walter K. Bachrach,
Harry C. Becker,
J. Ralph Bolgiano,
William Wallace Boyd,
G. Herman Carl,
Willis B. Clemmitt,
Charles H. Dorsey,
George Erck,
Harry C. Finck,
Edwin Friese,
John R. Guttmann,
John R. Haswell,
Charles W. Henderson,
George F. Heubeck,
Ralph Holbrook,
Andrew C. Kemler,
Howard G. Lanahan,
George F. Lehmann,
Frank T. Leilich,
Harold M. Lewis,
Bernard A. McAbee,
Carl F. Meyer,
*Sidney D. Mitchell,
Ferdinand Oppenheimer,
John G. Pertsch, Jr.,
Lewis W. Porter,
John T. Ridgely,
John C. Schirmer,
Edward K. Stembridge,
David B. Stewart, Jr.,
Levin H. Stewart,
Israel E. Stolberg,
Frank T. Suman,
*Nicholas C. Thalheimer,
Raymond M. Weaver,
George F. Wennagel,
George F. Wieghardt,
Philip H. Williamson,
Walter B. Wills,

*Deficient in Steam Engineering ; allowed a reëxamination in September and passed.

CLASS MEMORIALS.

Framed Portrait of Dr. Henry A. Rowland. Presented to the Institute by the Fourth Year Class of 1903.

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